MACHINERY

Design—Construction—Operation

Volume 46 JUNE, 1940 Number 10

Since the President of the United States made his stirring address on National Defense, no subject has occupied the attention of both engineers and the general public more than aviation. July MACHINERY—the Annual Aircraft Manufacturing Number—is therefore especially timely this year. Aircraft plants from coast to coast have contributed articles that deal with many phases of the manufacture of both the engines and the planes. These articles will describe the machining, forming, welding, and riveting of the hundreds of thousands of metal pieces that make up the planes of today.

PRINCIPAL ARTICLES IN THIS NUMBER

FOR COMPLETE CLASSIFIED CONTENTS, SEE PAGE 182

Machining Automobile Flywheels at the Chevrolet Plant
By Charles O. Herb 103

Monarch Study Courses for Trained Shop Men
By D. H. McKellar 108

Selecting the Best Material for a Given Application
By David R. Kellogg 113

Using One Set of Dies for Two Different Shells
By M. J. Goldstein 115

Editorial Comment 120
Now the Machine is Guilty of Destroying Priceless Violins—
Continued Training for the Man Already Trained

Flame-Hardening and Hard-Surfacing 123

Die Design for Inclinable Presses ..... *By Joseph I. Karash* 126

Die Steel with High Wear Resistance and Minimum Distortion .. 137

Metal Trades Convention Discusses Employer-Employe Relations 138

Gear Manufacturers Meet in the South 139

Meeting of Associated Machine Tool Dealers 139

Westinghouse Machine Tool Forum 140

Multiple "Oil-Wedge" Sleeve Bearing 142

DEPARTMENTS

Engineering News Flashes 118

Ingenious Mechanical Movements 121

Design of Tools and Fixtures 129

Ideas for the Shop and Drafting-Room 135

Questions and Answers 136

Materials of Industry 144

New Trade Literature 146

Shop Equipment News 149

PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette Street New York

ROBERT B. LUCHARS ..... *President*
EDGAR A. BECKER ..... *Vice-pres. and Treasurer*
ERIK OBERG ..... *Editor*
FRANKLIN D. JONES ..... *Associate Editor*
CHARLES O. HERB ..... *Associate Editor*
FREEMAN C. DUSTON ..... *Associate Editor*

LONDON: MACHINERY, 83-113 Euston Road
PARIS: La Machine Moderne, 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, $3 (two years, $5); foreign countries, $6. Single copies, 35 cents.

Changes in address must be received by the fifteenth of the month to be effective for the forthcoming issue.

Send old as well as new address.

Copyright 1940 by The Industrial Press.

Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879.
Printed in the United States of America
Member of A.B.P. Member of A.B.C.

Product Index 251-266

Advertisers Index 269-270

TOTAL DISTRIBUTION, 17,925

7 Steps to Faster Production

① Multiple Length Stops consist of telescopic type stop dogs for automatically disengaging the longitudinal feed when feeding toward the headstock. Quick and easy to set up, the use of this attachment makes possible automatic duplication of shoulders on repetitive work.

② The Multiple Diameter Stops are used for quickly duplicating diameters and when used in conjunction with the automatic Multiple Length Stops eliminate cut and try methods.

③ The Connected Rear Rest increases the tooling possibilities, since it enables mounting an additional tool holder or multiple tool holders for necking, grooving, forming and facing operations, practically doubling the productive capacity of the machine.

④ Various operations can be performed without changing tools by mounting four different tools in the Four Way Tool Block which can be indexed to twelve equally spaced positions.

⑤ The High Duty Tool Block, of heavy construction and with double screws for holding the tool, is regular equipment on Manufacturing Lathes. It can be supplemented by or replaced with multiple tool holders at a slight added cost.

⑥ The Manufacturing Lathes are equipped with a pump and suitable tubing delivering a deluge of coolant on tool and work, thus permitting the use of maximum cutting speeds.

⑦ The pressed steel Pan extends the full length of the bed and is equipped with strainer and an exceptionally large sump which can be filled to capacity and still keep the Pan free of lubricant.

THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO, U. S. A.

MACHINERY

Volume 46 NEW YORK, JUNE, 1940 Number 10

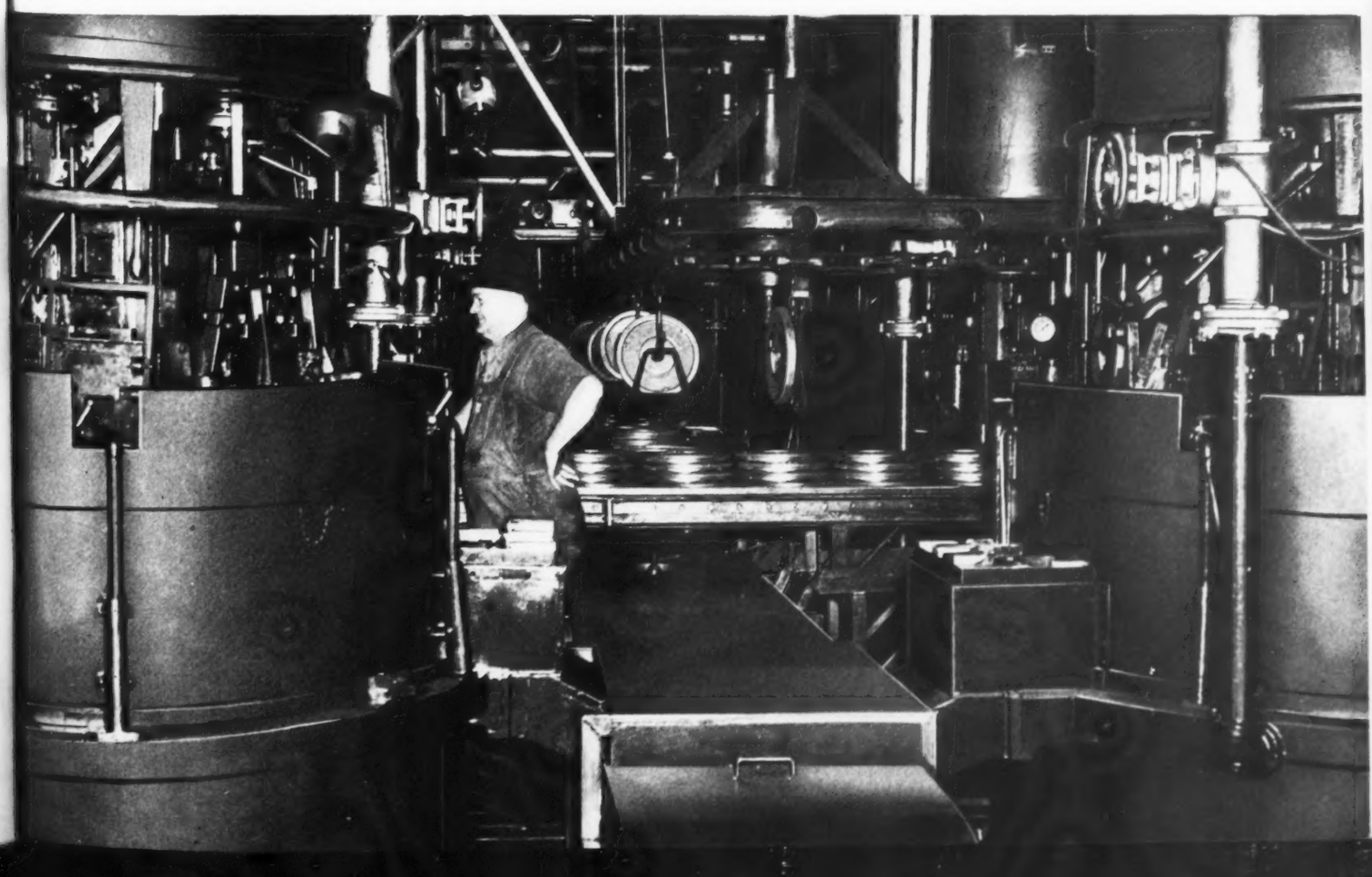
Machining Automobile Flywheels at the Chevrolet Plant

A Battery of Eight Mult-Au-Matics, Installed on Opposite Sides of a Chip Removal Conveyor, Rough and Finish the Flywheels in Two Operations

By *CHARLES O. HERB*

AMONG the extensive changes made in the manufacturing practice of the Chevrolet Motor Co. at the Flint, Mich., plant in the past year, was the installation of a battery of eight Mult-Au-Matics for rough- and finish-machining the flywheels. All turning, facing, and boring cuts are taken on both sides of the flywheels in two operations. The machines are arranged in two rows of four each with a chip conveyor between them. Those on one side of the conveyor machine the clutch side of the flywheels in the first operation, and those on the opposite side finish the motor side of the flywheels in the second operation. The flywheels are high-grade iron castings.

The rough flywheel castings are brought to the battery of Mult-Au-Matics on an overhead conveyor, as seen in the heading illustration, and are passed from the first- to the second-operation ma-



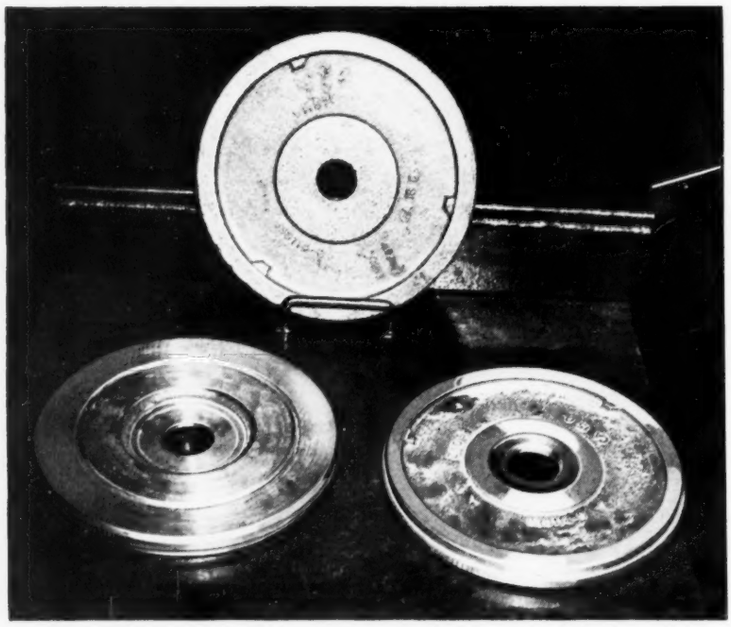


Fig. 1. Three Views of a Flywheel Showing the Rough Appearance and the Finished Clutch and Motor Sides

chines on roller type gravity conveyors. From the second operation, the flywheels are again loaded on the overhead conveyor to be transferred to other machines in the department. The rough flywheel casting is seen at the top in Fig. 1. The finished clutch side appears as shown at the lower left of the illustration, and the finished motor side as shown at the lower right.

One of the machines tooled up for performing the first operation is illustrated in Fig. 2, and the tooling provided in the various working stations is shown diagrammatically in Fig. 3. In the loading station, seen at the left in Fig. 2, there is a hydraulic locating device which holds the work central in the chuck until the jaws grip it securely around the periphery. A dial indicator on the locator housing shows the pressure applied by the locating plunger. The chucks are of three-jaw design. The work-table indexes from right to left around the machine column, carrying the flywheel successively to the five working stations and back to the loading station.

In the second station, tools on a plain vertical head move downward at a feed of 7/16 inch per work revolution, as shown in Fig. 3, to cut groove *E* (see loading station diagram) and a second groove to start the machining of surface *B* at its maximum diameter, and to chamfer corner *D*.

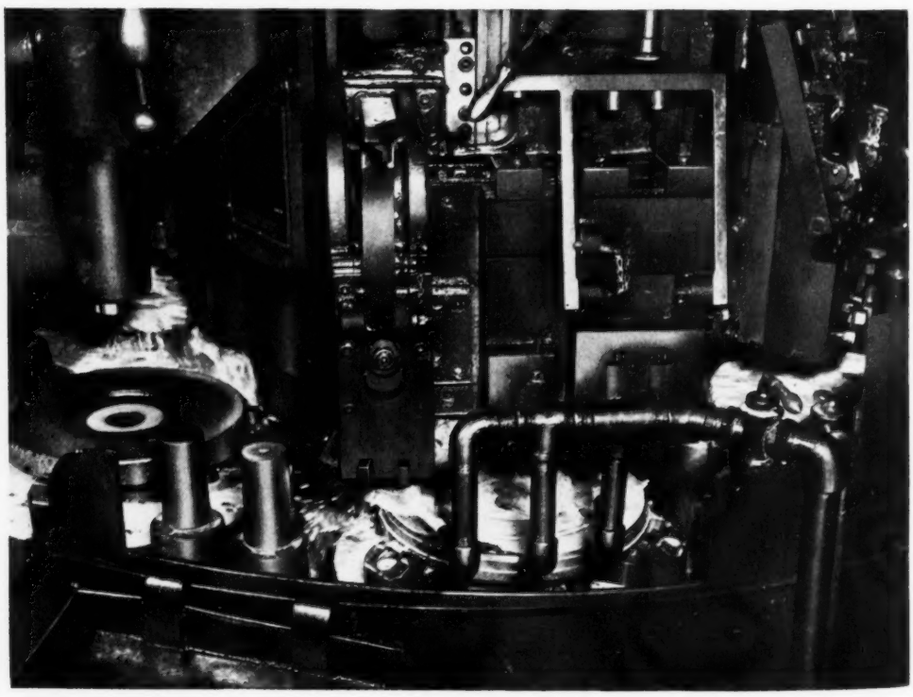


Fig. 2. Three Stations of One of the Mult-Au-Matics Used in Machining the Clutch Side of the Flywheels in the First Operation

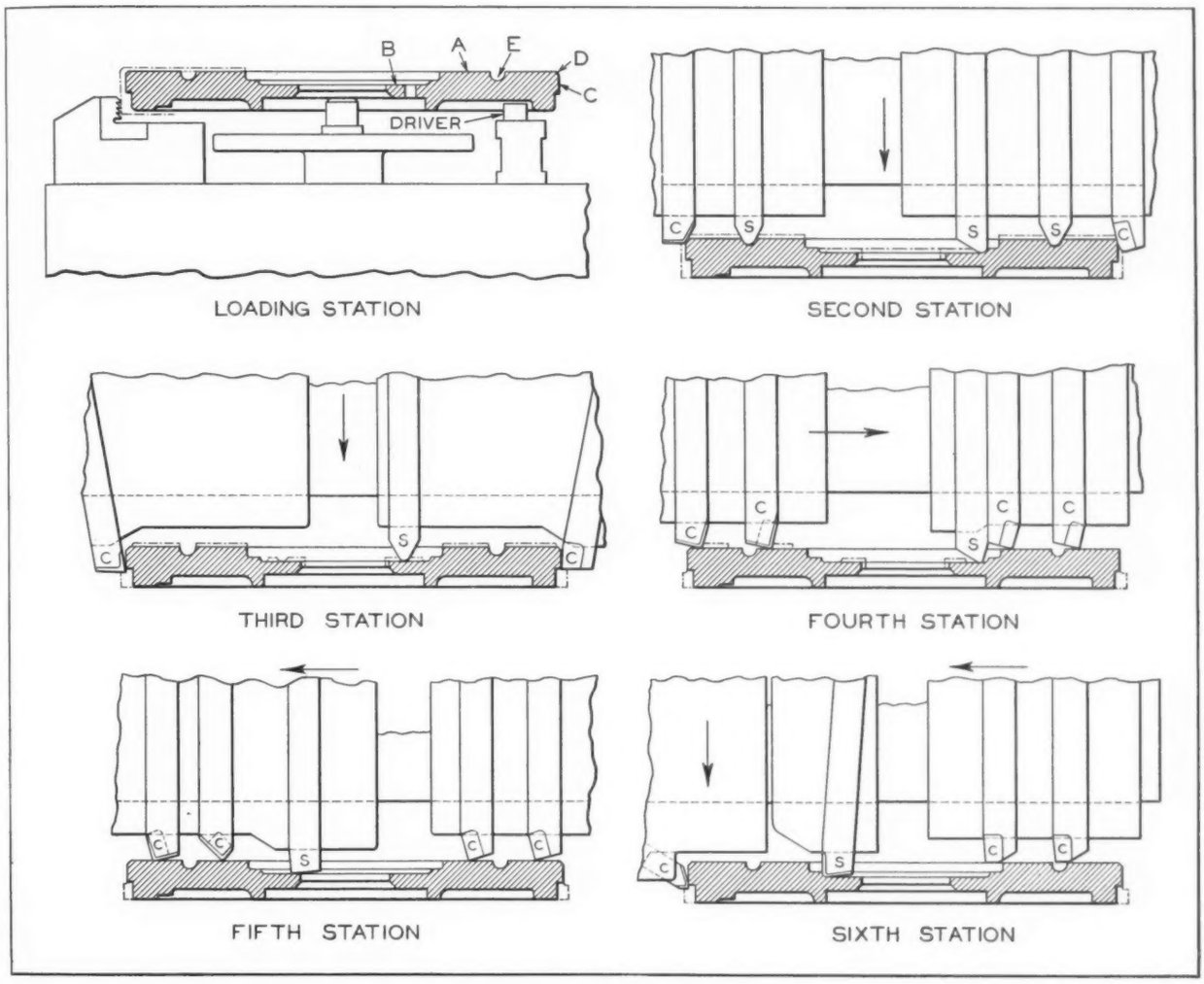


Fig. 3. Diagrams of the Tooling Provided in the Five Working Stations of the Mult-Au-Matics Employed for the First Operation on the Flywheels

In the third station, tools on a plain vertical head move downward for rough-turning periphery *C* and cutting another groove in surface *B*, the feed in this case being 17/32 inch per revolution. In the fourth station, tools on a plain compound head are fed horizontally after having been moved downward to the required depth, for rough-facing approximately one-half the width of surfaces *A* and *B*, the feed being 9/16 inch per work revolution.

The fifth station is provided with a second plain compound head which moves tools horizontally in the opposite direction to the tool movement in the fourth station, for rough-facing the remainder of surfaces *A* and *B*. The feed in this case is 5/8 inch per work revolution.

Finally, in the sixth station, tools on a plain compound head equipped with an auxiliary turning tool are fed downward for finish-turning rim *C* and sidewise for finish-facing surfaces *A* and *B*. The turning tool is fed downward at the rate of 3/4 inch per work revolution, while the facing tools are fed horizontally at approximately 2 inches per work revolution.

When the flywheel again reaches the loading station, an elevating mechanism lifts it clear of the chuck jaws, so that the machine operator can slide the casting to the roller gravity conveyor without actually lifting it. All the tool-heads of the machine are accurately guided in relation to the flywheels by bushings on the tool-heads sliding over vertical posts provided on the indexing table of the machine.

In Fig. 4 is shown a close-up view of one of the Mult-Au-Matics employed for the second chucking of the flywheels, the loading station being seen in the center of the illustration. Fig. 5 shows diagrams of the tooling employed in the second operation, which is performed on the motor side of the flywheels, as previously mentioned.

Referring to the reference letters in Fig. 5 on the diagram for the loading station, it will be seen that in the second station, tools on a plain vertical head are fed downward for rough-boring shoulder *L*, chamfering corner *N*, and rough-turning part of surface *J*. This tool-head is fed downward at the rate of 3/8 inch per work revolution.

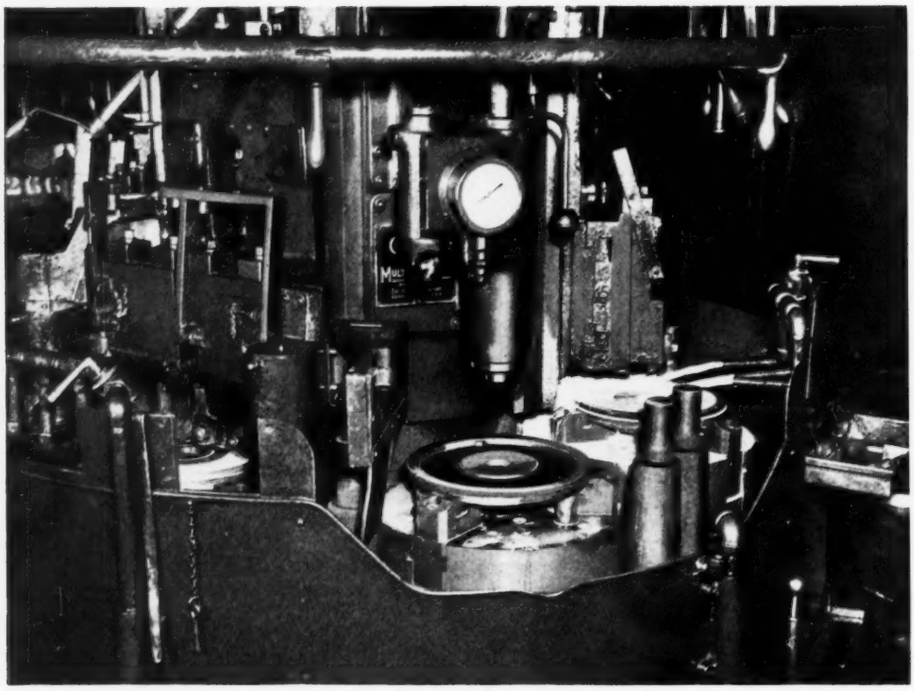
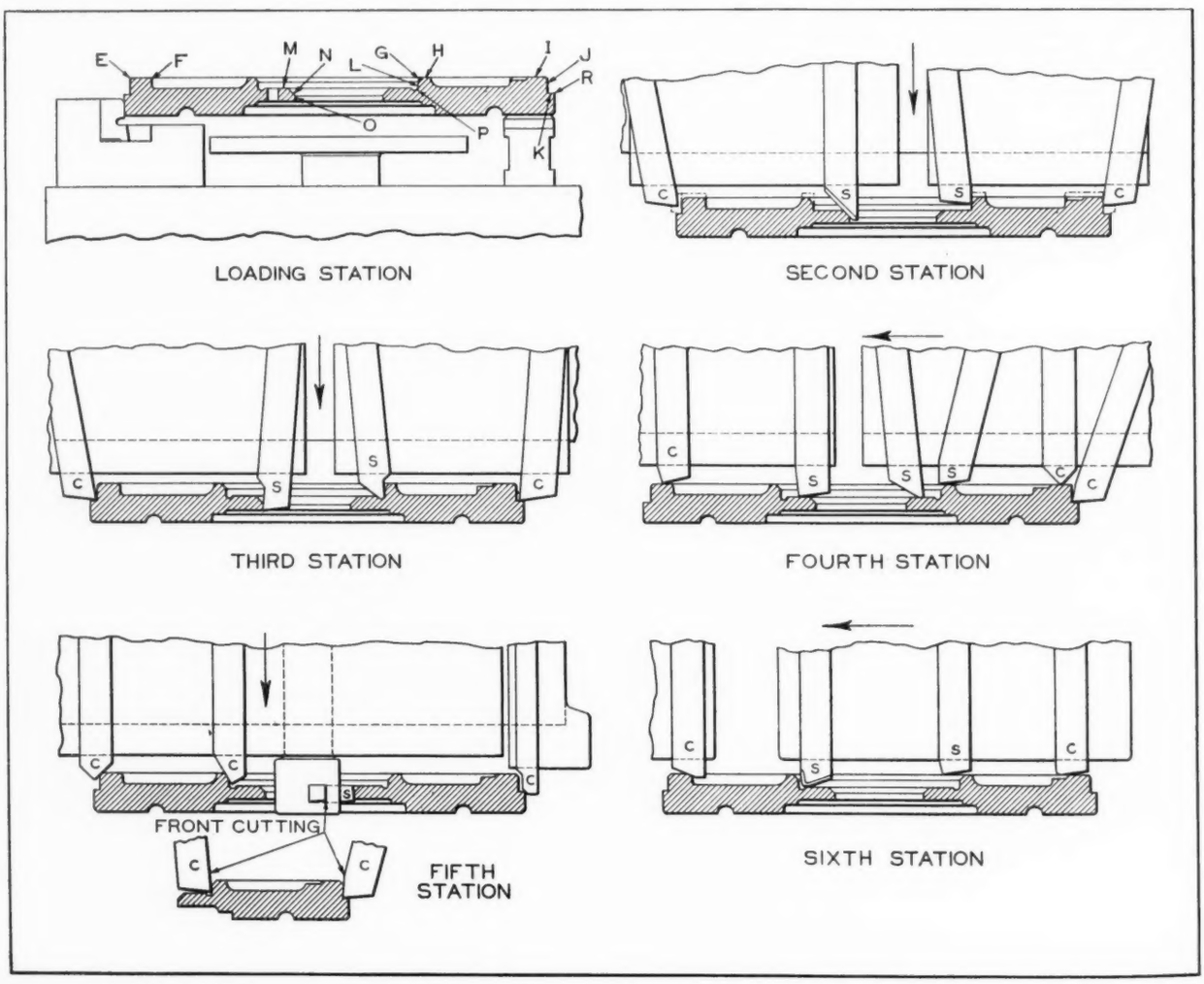


Fig. 4. (Left) Three Stations of One of the Mult-Au-Matics Tooled up for Machining the Motor Side of Flywheels

Fig. 5. (Below) Diagrams of the Tooling Provided in the Five Working Stations of the Mult-Au-Matics that Finish the Motor Side of the Flywheels



In the third station, the tools on a plain vertical head are fed downward at the rate of 13/32 inch per work revolution for rough-turning the remainder of surface *J*, rough-boring hole *O*, finish-boring shoulder *L*, and turning recess *P*.

The fourth station of the machine is equipped with a plain compound head which is fed horizontally at the rate of 9/16 inch per work revolution for rough-facing surfaces *H*, *I*, *K*, and *M*. The fifth station is equipped with a plain vertical head that is fed downward at the rate of 9/16 inch per work revolution for finish-turning surface *J*, finish-boring hole *O* and shoulder *L*, and chamfering corners *E*, *G*, and *R*. Finally, in the sixth station, there is a plain compound head that is fed horizontally at the rate of 31/32 inch per work revolution for finish-facing surfaces *H*, *I*, and *M*, and for chamfering corner *F*.

Proper setting of all tools on the Mult-Au-Matics is insured by gages permanently mounted on the machines. As may be seen in Figs. 2 and 4, these gages are attached to swinging holders that are fastened to the tool-heads. By swinging these holders downward and applying feeler gages between the gage-blocks and the tools, the settings of the tools can be readily ascertained and adjustments made.

All of the chips and coolant coming from the machines drain down troughs such as seen in the heading illustration to a central trough and chip conveyor which lead to a coolant pit in the floor. The coolant flows into the pit, and the chips are carried there by a link chain conveyor. The chips are transferred from the coolant pit by a vertical bucket conveyor to an overhead hopper, from which they can be discharged on trucks, as shown in Fig. 6. The coolant is filtered and recirculated to the machines. This arrangement has greatly facilitated the disposal of the chips and the reclaiming of the coolant.

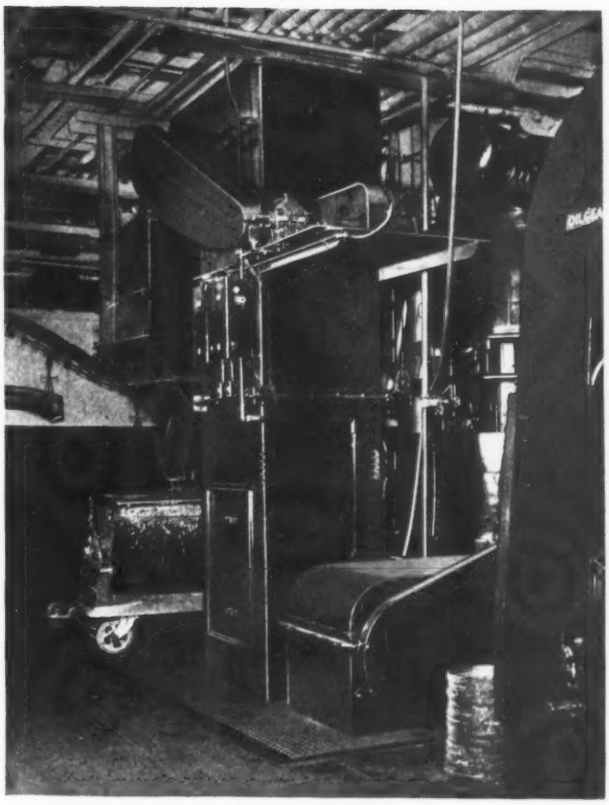


Fig. 6. End of the Chip Conveyor Line, Showing Enclosed Bucket Elevator which Carries Chips from the Sump Pit to an Overhead Hopper

What Industrial Research Means

IN a booklet published by Revere Copper and Brass, Inc., 230 Park Ave., New York City, especially intended for the employes of the company, the case for research and for the research worker is very clearly and concisely stated. The booklet points out that modern industry continually demands the development of new and better products designed to meet specific needs. Industrial research men are required to obtain the knowledge necessary to meet the needs of industry and the community, due to constantly changing conditions.

Engineering and industry today demand exact and specific knowledge of the properties of materials. The manufacturer of such materials must supply this specific and detailed knowledge. It is the duty of research departments, through special study and tests, to compile the necessary facts and to distribute the information demanded.

Competitive conditions today make necessary constant effort by each manufacturer to maintain his manufacturing methods on as efficient a basis as his competitors' methods. It is a function of the research engineer to cooperate with the production and manufacturing departments in improving methods and supervising manufacturing procedure.

Research men should serve not only their own company, but their industry as a whole. This service includes the spread of information on the properties and applications of their company's products.

* * *

Mass participation in the fruits of American business enterprise, long the marvel of other nations, has been accepted as commonplace. Only recently have we, as a people, realized that our well-being, unlike Topsy, did not "just grow," but that it is, in fact, the planned result of the American way of life.—*New York World-Telegram*

Monarch Study Courses for Trained Shop Men

Pioneering in a New Field of Mechanical Education, the Monarch Machine Tool Co. has Inaugurated Courses of Supplementary Study for Men Already Trained or Skilled

By D. H. McKELLAR, Director of Training
Monarch Machine Tool Co., Sidney, Ohio

AT the end of March, one hundred and forty men employed in the Monarch Machine Tool Co.'s shop at Sidney, Ohio, completed a rather unique course of study. Draftsmen and highly skilled machine tool operators; newly engaged men and members of the company's twenty-five year club; grammar school and college graduates—all have been attending special study classes that were started last September.

Although the project was undertaken more or less as an experiment, the fact that almost 90 per cent of those who enrolled completed the wholly voluntary six-months' courses indicates the success of this training program. The enrollment represented more than 25 per cent of the entire shop force at the time the school was organized.

For several years, the Monarch company, like most firms in the machine tool industry, has been conducting a training school for apprentices and for foremen. A short time ago, it was thought that it would be well to provide educational opportunities for those men who are neither apprentices nor foremen, but who comprise the largest group of employes. This group is almost universally neglected, as far as company training schools are concerned. These men are handling their jobs creditably—or they would not be handling them at all—but the responsibility of keeping technically well informed, as well as physically and mentally able to fill their jobs, is their own responsibility under our competitive system. While most shop men, in addition to improving their general skill, do pick up some technical information about their work, the information they acquire is haphazard and meagre, and woefully short on theory.

New Machine Tool Designs Require Broader Knowledge

Today, it is more important than ever that men engaged in building and operating machine tools should not only be highly skilled, but well informed on the underlying theory of their work, and able, from the educational point of view, to cope with increasingly difficult problems, for modern machine tools are no longer simple in either assembly or operation. Thirty years ago, when machine tools were comparatively simple in design, they were highly standardized and built in large quantities, the designs remaining the same for years. Today the designs are continuously changing, and many machines are almost custom-built. New sources of power—electric, air, and hydraulic—with their complicated controls are built into machines as integral parts of the design. All this greatly increases the basic knowledge required by the men who build and use these machines.

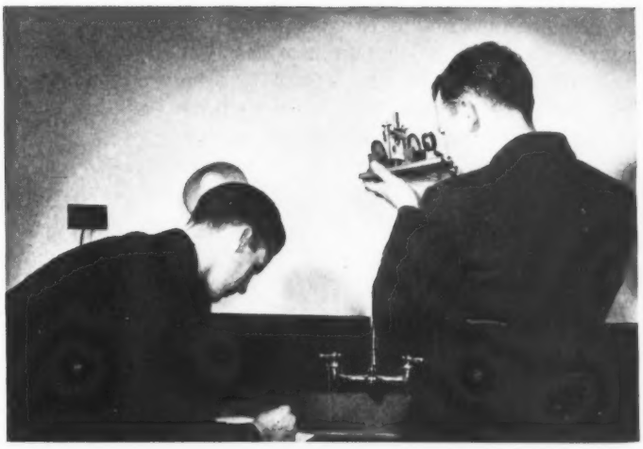
It was in the belief that the men in the shop would realize that they could profit materially from a study course, and that they would be just as much interested in knowing the *why* as the *how*, that the Monarch company, last fall, offered a series of three courses to all who wanted to give an hour and a half a week of their own time to study. The response was far greater than was expected.

Types of Courses Offered

Three courses were offered: (1) Machine shop technology; (2) measuring instruments and shop calculations; and (3) blueprint reading. The machine shop technology course proved to be the most popular. This course includes studies of such subjects as the properties and behavior of metals; the shaping, forming, and heat-treatment of metals; tool-room grinding; chip formation; principles of tool design; etc.

The measuring instruments and shop calculations course covers such instruments as slide-rules, verniers, and micrometers, and includes a review of the derivation of formulas and the calculation of speeds and feeds, time studies, and costs. The third course covers the theory of mechanical design, drawing-room standards, analysis of shop drawings with emphasis on manufacturing procedure, and similar subjects allied to the reading of blueprints.

In the study of compression stresses and chip fracture in machining steel, pieces of various materials are inspected through polarized light. Small polarizing instruments, which the students can hold in their hands, are used for this purpose.



To stimulate the student's understanding of drawings and his ability to visualize an object from the various projections shown on a drawing, the student is supplied with modeling clay, from which he actually produces objects shaped as drawn by the instructor on the blackboard.

The students not only are instructed in the general principles and theory of heat-treatment, but are given an opportunity to prove the accuracy of the theories by performing heat-treating operations in the school shop laboratory.

The slide-rule would become a more generally used tool among mechanics if they realized how easy it is to operate. A class is being instructed in the use of the slide-rule by means of a large model operated by the instructor.

No one is allowed to take more than one course, although many of the men wanted to do so. Each course is taught in two separate sessions, in order to make the classes available to both the day and night shifts and to limit the number of men in each class to thirty.

Principles to be Observed in Planning Courses

It was realized at the outset that most shop men have little patience, if not a thorough dislike, for formal schooling; also, that although men might realize the value of further educational study, the work would have to be interesting and require little abstract study on their part to keep them coming back for more.

With this in mind, the work has been planned to make it as interesting as possible. All written work is reduced to a minimum. Probably 80 per cent of the classroom work is visual. As a further aid, the newest mechanical teaching facilities are employed, such as a 16-millimeter sound projector, a still film machine which can be used with or without a sound attachment, a lantern slide projector, an opaque projector, models, and a variety of other laboratory apparatus.

In line with the best modern pedagogy—learning by doing—laboratory work and activities that require student participation are substituted whenever feasible for reading and writing assignments, which are likely to be slow and uninteresting, and for lectures, which are passive and too frequently ineffective.

How this learning-by-doing principle is utilized is shown in the accompanying illustrations. To stimulate visualization of drawings, for example, the students are given modeling clay and allowed to actually produce the objects drawn by the instructor. In the study of stresses and chip fracture in machining metal, pieces of various materials are studied through polarized light. Small polarizing instruments that the students can hold in their hands are used for the purpose. In the study of mechanical motions, cut-away working models are utilized which the students operate themselves. No textbooks are used. All the information is presented in lesson sheet form, the subject matter being reduced to a few significant notes. The lessons are then arranged in units for learning.

The home work for each unit consists of a single sheet of one-sentence questions that can be answered simply by filling in one or two words. In all the trade training work at the Monarch company, use is made of this modern teaching practice. The work for the six months' period has not, of course, been graded, and there is no attempt to compare the work of individual students.

In the study of mechanical motions, working models, which the students can operate themselves, are used.

Although only a minimum of reading is required, all courses include, at the beginning, several sessions on how to study effectively. This is worth while for a number of reasons, not the least of which is the fact that learning how to study means learning how to organize new information in usable form. Practice in reading rapidly and efficiently, and in memorizing new information, is emphasized in these how-to-study sessions.

Facilities for study and training were provided in the company's recently constructed air-conditioned office building. There is a large combination classroom and laboratory equipped with the most modern facilities and apparatus, and a reference library room for conferences and study.

Some indication of how much interest and enthusiasm have been evoked by these courses is evidenced by the fact that when classes were scheduled, many of the men came to the plant hours before they were due and lingered on for some time after the lesson was over. One of the men who lives in a town twenty miles away "thumbed" his way to the classes, because his regular means of transportation was not available. Thus, the desire for study and the success won by study is by no means dead. There are many shop men who realize that the successful mechanic of tomorrow must be not only a highly skilled artisan, but also a man equipped with knowledge of new technical developments that will enable him to meet intelligently the problems that come his way.

Some of the Questions Answered by the Students

As examples of the test questions asked and the form in which they are arranged, the following examples may be of interest:

Write the S A E number for nickel steel with 3 per cent nickel and 0.20 to 0.30 per cent carbon.

The rake angles are always on the (?) of the tool.

The best finish on cast iron is produced by a (?) chip.

Fibrous layers conducive to machinability are introduced into steel by adding (?).

* * *

The Pontiac Motor Division of the General Motors Corporation will produce the two-millionth Pontiac car early in June. The first Pontiac was built in January, 1926, and set a record for the first-year production of any American automobile. The one-millionth car was built in 1935.

MECHANICAL PROPERTIES OF MONEL, NICKEL, AND INCONEL IN FORMS USED FOR MACHINING

	Tensile Strength, Pounds per Square Inch	Yield Strength (0.5 Per Cent Set), Pounds per Square Inch	Elongation in 2 Inches, Per Cent	Brinell Hardness, 3000 Kilograms
Cold-drawn "as drawn" rods and bars to 3 inches				
Monel	85–125,000	60– 95,000	35–15	160–220
R-Monel	80–115,000	50– 90,000	35–15	145–210
Nickel	80–115,000	60– 90,000	35–15	145–200
Inconel	100–130,000	80–105,000	40–20	165–250
Cold-drawn "annealed" rods and bars to 3 inches				
Monel	70–85,000	25–35,000	50–35	120–160
Nickel	65–85,000	20–30,000	50–35	100–140
Inconel	80–95,000	30–45,000	55–45	130–170
Hot-rolled rods and bars to 3 inches				
Monel	80– 95,000	40–65,000	45–30	130–170
R-Monel	75– 85,000	35–60,000	45–30	130–165
Nickel	70– 85,000	20–30,000	45–30	110–150
Inconel	95–115,000	40–85,000	50–25	145–200
Round forgings* over 3 inches to 9 inches diameter				
Monel	85–110,000	60– 95,000	40–15	175–200
Nickel	80–105,000	50– 80,000	40–15	150–180
Inconel	95–115,000	70–100,000	45–25	185–235
K-Monel				
Hot-rolled or forged	110,000 max.	70,000 max.	30	190 max.
Hot-rolled or forged Heat-treated	140,000 min.	100,000 min.	20	265 min.
As cold-drawn 3/8 to 1 inch diameter	135,000 max.	100,000 max.	13	260 max.
As cold-drawn 3/8 to 1 inch diameter Heat-treated	145,000 min.	110,000 min.	15	290 min.
As cold-drawn 1 to 3 inches diameter	125,000 max.	100,000 max.	13	240 max.
As cold-drawn 1 to 3 inches diameter Heat-treated	140,000 min.	100,000 min.	17	265 min.
Castings (as cast)				
Monel	65– 80,000	32.5–40,000	45–25	125–150
H-Monel	70– 90,000	45 –65,000	20–10	175–250
S-Monel	90–115,000	70 –90,000	3–1	275–350
Nickel	55– 70,000	20 –30,000	30–15	100–130
Inconel	85,000	50,000	10	200

*Values obtained on special high-strength forgings are included in ranges given.

MACHINERY'S Data Sheet No. 420, June, 1940

Compiled by the International Nickel Co., Inc., New York

MACHINERY, June, 1940

RECOMMENDED CUTS, FEEDS, AND SPEEDS FOR TURNING MONEL, NICKEL, AND INCONEL IN THE LATHE

Depth of Cut, Inches	Feed, Inches	Cutting Speed, Feet per Minute: Wrought Monel; Nickel	Wrought K-Monel (Unhardened); Inconel	Cast Nickel	Cast Monel	Cast H-Monel; Cast S-Monel (Annealed)	Cast S-Monel (As Cast)
1/32	0.008	168	115	-----	—	—	—
	1/64	139	85	110	90	60	30
	1/32	118	75	95	80	55	27
1/16	1/64	121	75	95	80	55	27
	1/32	104	65	80	70	45	22
	1/16	60	40	55	45	30	15
1/8	1/64	110	70	85	75	50	25
	1/32	68	45	60	50	35	17
	1/16	48	35	55	40	25	13
	1/8	34	25	35	30	20	10
1/4	1/32	57	37	—	—		
	1/16	39	27	—	—		
	1/8	29	20	—	—		
3/8	1/32	52	30	—	—		
	1/16	34	25	—	—		
	1/8	24	15	—	—		
1/2	1/32	49	32	—	—		
	1/16	31	20	—	—		
	1/8	21	15	—	—		

In the two columns above, the feeds and speeds apply to cutting with cemented-carbide tools. Reduce 50 per cent for cutting with regular high-speed steel tools.

In turning and boring these metals, it is decidedly more economical from the point of view of tool life, whether cutting dry or with lubricants, to take a deep cut and a light feed rather than a light cut and a heavy feed.

The speeds shown above are for turning, and must be reduced in most cases for boring operations, because in boring, the cooling and lubricating efficiency is not so great, nor can the cutting tool be as rigidly supported.

MACHINERY'S Data Sheet No. 419, June, 1940

Compiled by the International Nickel Co., Inc., New York

Selecting the Best Material for a Given Application

Taking Sash Weights and Silver Whistles as Primary Examples, the Author Outlines the Principles Involved in Selecting the Material Most Satisfactory for a Given Application

By DAVID R. KELLOGG
Engineering Laboratories and Standards Division
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

At first glance, it would appear that sash weights and silver whistles have nothing in common except that they are both made of metal. They do, however, share another important characteristic, in that each is made from the *best* material available for the purpose. Do I hear someone say that the hard, brittle, rough-surfaced, low-grade cast iron used for sash weights is not even a good material, to say nothing of the best? As a matter of fact, it would be more difficult to defend silver as the best material for whistles—except when there is a special demand for purity of tone, perfection of finish, suitability for engraving, and extremely long life.

What do we mean when we speak of the best material in manufacturing? If we define it as the material that most satisfactorily performs the desired function at the lowest over-all cost during the desired life, we shall have a good starting point. The term "over-all cost" means not only purchase price of the material, but cost of fabrication and maintenance, and the less definite but none the less real cost of delays due to repairs, replacements, or reconditioning.

"Desired life" is also worthy of consideration, as some articles of manufacture are expected to have an almost indefinite life, while others are perfectly satisfactory if they last a few years, months, or even days. I do not mean to be facetious when I say that wedding rings are a case in point. They serve to illustrate the idea very well. For some marriages, brass with a thin—very thin—wash of gold would be adequate.

Thirty years ago, the writer made the mistake of buying one made of too good gold. In his enthusiasm that the best was none too good, he bought an 18-karat ring. This proved to be so soft that it wore rapidly and is now but a shadow of its former self, although it still serves its original purpose. If the harder 14-karat gold had been chosen, it is probable that it would not have shown serious wear in these thirty years.

To return to the sash weights, what are the requirements? What should a sash weight be like to give satisfactory service for the desired life? It should provide mass on one end of the cord, resist light and infrequent rubbing, be sufficiently tough for handling in shipment, and corrosion-resistant enough not to lose too much weight during its period of service or if stored outdoors. It does not need to provide a very large mass for a given volume, as lead, gold, or platinum would; nor need it be strongly shock-resistant like mild steel; nor hard, like tool steel or tungsten carbide; nor easily machinable; nor need it take a beautiful finish. On all these counts, therefore, the cheap cast-iron weight is ideal. The cost per year is also low, there being no need for reconditioning or refinishing.

The silver, out of which the whistle chosen as our other example is made, would serve equally well in every particular, except that, because of its cost, it would be a decidedly unsuitable material for sash weights. Those properties that make silver valuable for whistles (and many other uses) would, however, serve no purpose in sash weights. By the same token, the cheap, easily rusting, rough, sash-weight iron would make a poor whistle.

All this discussion is intended to emphasize only one point—that there is no material that is either good or poor except as its application makes it so. A corollary of this is the fact that good design includes the selection of materials having the desired properties in the proper degree. For many applications, for example, cold-rolled steel is adequately strong and sufficiently shock- and corrosion-resisting. Alloy steels have these properties to a much greater degree, but their higher cost would make them distinctly less suitable for applications where cold-rolled steel is satisfactory.

An illustration of a wrong choice of material which resulted not in physical failure, but in increased expense, is furnished by a case involving two bronzes. For years, a certain bronze had been used for a purely mechanical application, and had

been found perfectly satisfactory. Later, when the electrical resistance of this bronze was found to vary too widely for a new application in which this feature was important, a new bronze was developed in which the electrical resistance was closely controlled; the cost of the bronze was, of course, considerably increased. This gave two materials of practically identical physical properties, one of which was much more expensive than the other. A design engineer, looking for a good bronze for a purely mechanical application, picked the newly developed electrical grade, and, of course, found it entirely satisfactory. As a result, for years the higher priced of the two mechanically equivalent materials continued to be used, when the less expensive bronze would have been just as good.

Further Examples of the Wrong Choice of Materials in the Machine-Building Field

Another example of poor design is the use of yellow brass screws to hold the washers in domestic water faucets. The body of the faucets is made of a bronze which resists corrosion quite well. A screw made of similar material would cost a fraction of a cent more than the yellow brass one and would always be in good condition when the washer needed renewing. The yellow brass screw, again, almost always suffers "dezincification," leaving a honeycomb structure which results in a broken screw when an attempt is made to remove it.

Does this mean that yellow brass is a poor material? No, not at all; but it does indicate that it should not be used under water, and particularly not under water in contact with another metal. Red brass—that is, brass having 70 or more per cent of copper; bronzes; or almost any of the precipitation hardening copper alloys could be used advantageously. All of these high-copper alloys are more expensive and less easily machined than yellow brass; hence, while they ought to be used in water faucets, there would be many applications where they would be poorer choices than the cheaper and more easily machined yellow brass.

Let us take another illustration. A manufacturer of temperature-control instruments, having heard that Micarta is a good insulator, chose it as a backing for the make-and-break part of a rotary switch. Micarta is strong, reasonably resilient and shock-resistant, low in moisture absorption, high in dielectric breakdown, and low in power loss. The material has, however, one weakness in that it "tracks"—that is, it forms conducting paths when an arc is drawn across its surface. Since, in this application, arcs were so drawn, the apparatus with Micarta insulation soon provided its manufacturer with many headaches.

In this case, instead of Micarta, the urea resins would have been better; the thermoplastic resins would have been satisfactory if the temperature of operation were not too high; but there is a material that would have been ideal, although, because of its high moisture-absorption property, it is generally frowned on for electrical applications. In respect to its behavior under arcing, however, it positively shines. This material is hard fiber, which derives its suitability for use where arcing occurs from the fact that the arc completely destroys the surface it touches, leaving the rest of the material clean and non-conductive. Of course, fiber does not have an indefinite life under these conditions, but it stands up surprisingly well.

The Important Thing is to Give Careful Thought to the Selection of Materials

These few examples indicate the need for great care in the selection of materials; but how is any one engineer to know all about the materials he may need to use? The answer is, he cannot; nor does he need to, although the more complete his knowledge of materials, the better.

There are several sources of helpful information available to the conscientious designer. The engineering journals are mines of information concerning the properties and use of materials—particularly the newer ones; the literature of the material manufacturers is extremely valuable, although some of it must be taken with a grain of salt; and the suppliers' representatives are, in many cases, very helpful regarding the use of the materials they handle.

Here we come to one of the most important points—the material from which human nature is made. The men who write sales literature range all the way from sound, intellectual, honest, and careful experts to over-enthusiastic publicity writers; and salesmen range all the way from order-takers, who offer nothing but a pleasant smile and a good "line," to carefully trained, widely experienced specialists, whose advice is disinterested and whose recommendations can be relied upon.

Another source of help available in larger organizations—but seldom adequately used—is the man or men who specialize in materials and processes. But even the best specialist can seldom give good advice unless the designer takes him fully into his confidence and tells him all the details surrounding the intended use of the material. Questions too narrow in their scope, calling for too general an answer, often lead to insufficient or misleading advice. The reticence on the part of the designer may not be intentional, but haste and carelessness in stating the problem produce equally bad results.

To sum up, it is well to remember that for each application there is always a "best" material—or possibly several so nearly alike that there is little choice between them. This best material, however, can be selected with certainty only after a careful consideration of all the factors of desired performance and cost, and usually after seeking the advice of those who are fully informed as to the properties and behavior of the class of materials under consideration.

Using One Set of Dies for Two Different Shells

By M. J. GOLDSTEIN

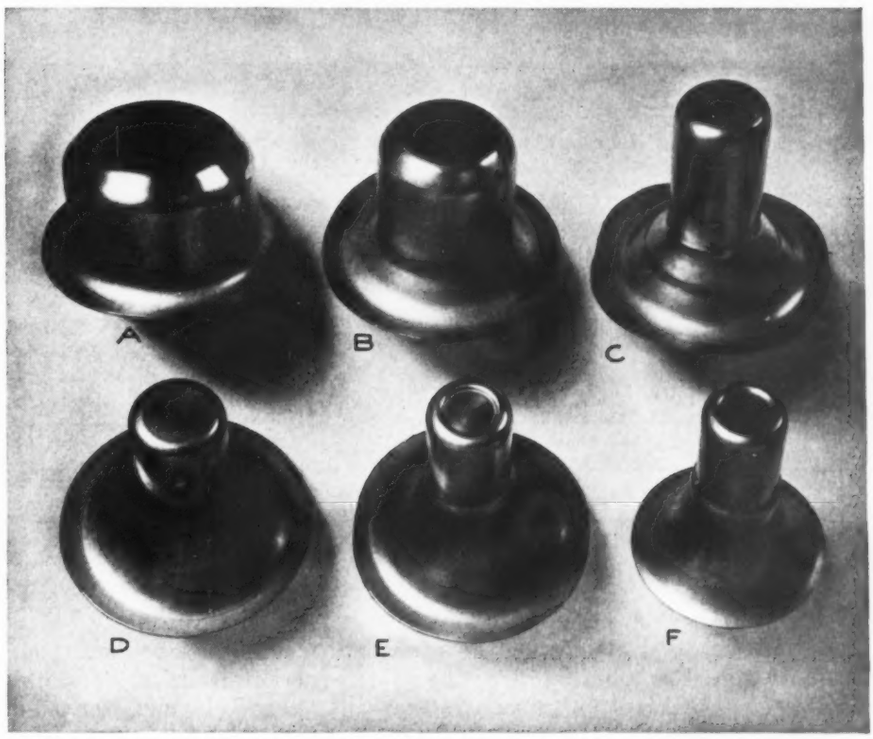
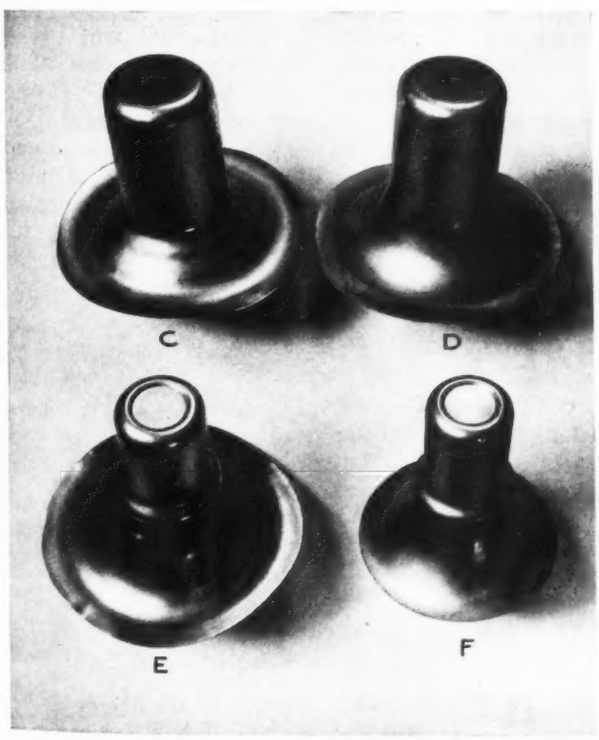


Fig. 1. (Above) Six Steps in the Evolution of the Shell F Drawn in the Dies Shown in Figs. 3 and 6. Fig. 2. (Below) Four Steps in Producing Beaded Shell F, Using the Same Dies as for Shell F, Fig. 1

MAKING dies for producing shells such as shown at *F*, Fig. 1, presents no great difficulty, but using the same dies for a shell having a different contour, like the one shown at *F*, Fig. 2, is an interesting and unusual procedure. Both shells are drawn alike in the first and second operations, as indicated at *A* and *B*, Fig. 1. The third operation in producing shell *F*, Fig. 2, draws the shell to a slightly larger diameter, but the succeeding dies are used for both shells.

The die used in the first operation for forming shell *A*, Fig. 1, is shown at *A*, Fig. 3. The shoes for both the die and the blank-holder are made of cast iron and have tool-steel rings that are hardened and ground to a forced fit in the castings. The blank-holder ring is of plain design, while the die ring has a 1/2-inch radius on the drawing edge, which is ground and highly polished. The blank is located on the die by three pins. The punch is made of cold-rolled steel, and has a standard 1 3/8-inch thread, eight threads per inch, by which it is attached to the center slide of the draw press.



The end of the punch is formed to an angle of 45 degrees, with the corners well rounded. The metal from which the shells are drawn is 22-gage steel, 0.025 inch thick. The blank is 7 1/2 inches in diameter. A good quality of deep-drawing steel is required for a shell of this type, steel of No. 4 temper having a Rockwell hardness of B50 being best suited for this work. Shell *A*, Fig. 1, when drawn in this die, has a diameter of 3 7/8 inches and is drawn to a depth of 2 1/2 inches. This operation leaves the flange 5 1/4 inches in diameter, and gives sufficient surface for holding the shell while it is being stretched to the required shape in the fourth operation.

The second operation reduces the diameter of the shell to 2 7/8 inches and increases the height to

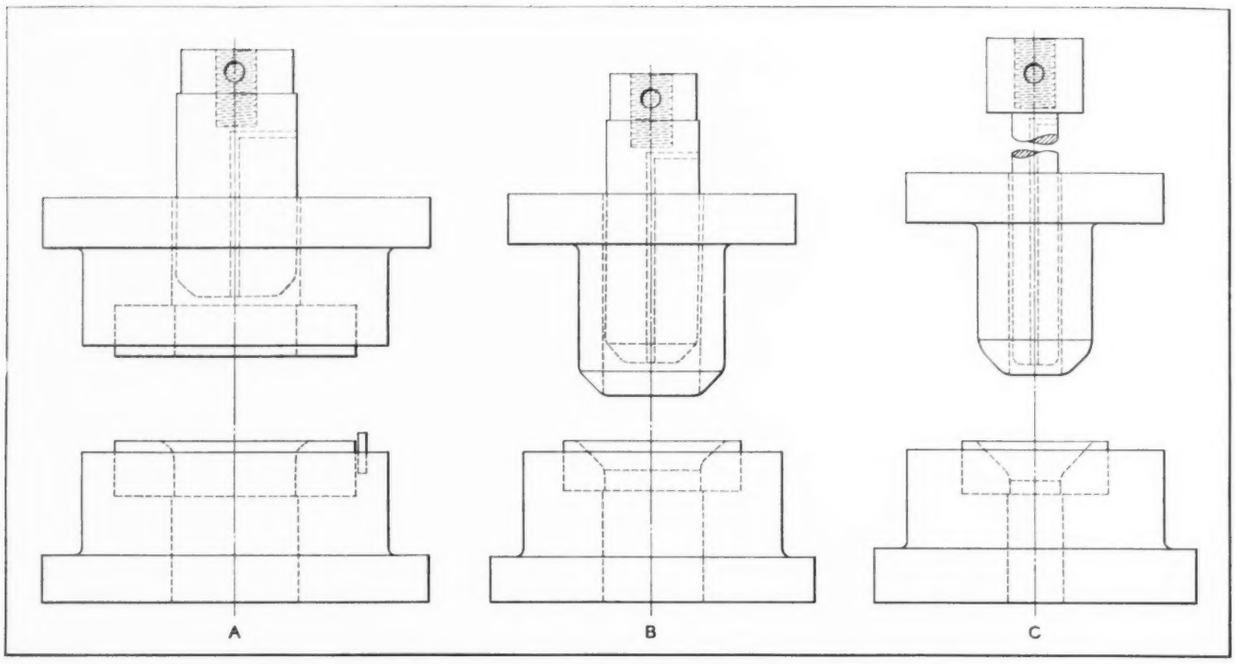


Fig. 3. Diagrams Showing Design of Dies Used in Forming Shell to the Shapes Shown at A, B, and C, Fig. 1

3 1/4 inches. A reduction of 20 per cent is generally accepted as maximum for the first reduction on this class of work, but about 25 per cent reduction is obtained with the die shown at *B*, Fig. 3.

This die consists of a tool-steel ring, machined to an angle of 45 degrees. The ring is hardened and ground, and is forced into a cast-iron shoe. The blank-holder is of tool steel, with a machine-steel back, and has a 45-degree angle to match the angle on the die. The blank-holder is hardened and ground and the corners are well rounded to permit easy flow of the metal. The reduction in the diameter of the shell is brought right up to the radius formed in the first operation.

The third operation is very unusual, since the reduction in diameter is about 32 per cent, compared with the usual 15 per cent for a second-reduction operation. The shell is reduced to 1.925 inches for a length of 3 inches. The die and blank-holder are like those used for the second operation.

The die has a radius of 1/2 inch, and the angular surface is highly polished. The blank-holder is formed to a 45-degree angle, with the corners well rounded, as shown at *C*, Fig. 3, the die, blank-holder and punch also being shown in Fig. 4. This die is used in a No. 1 1/2 Bliss draw press. The secret of the great reduction obtained is in the large radius on the die, which gives a smaller pressure surface and an easier flow of the metal from the larger to the smaller diameter.

The pressure applied by the blank-holder must not be excessive; otherwise, the shell will break before the full depth of the draw is reached. The weight of the blank-holder slide in the case of the die shown in Fig. 4 provides sufficient pressure for the production of perfect shells. The shell produced by this die is shown at *C*, Fig. 1. The height of this shell is 4 1/4 inches. The 45-degree angular portion developed is formed into the flare of the shell in the next operation.

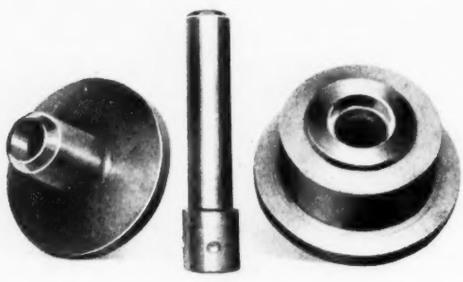


Fig. 4. Blank-holder, Punch, and Die Shown Diagrammatically at C, Fig. 3

Fig. 5. Blank-holder, Punch, and Die Shown Diagrammatically at D, Fig. 6

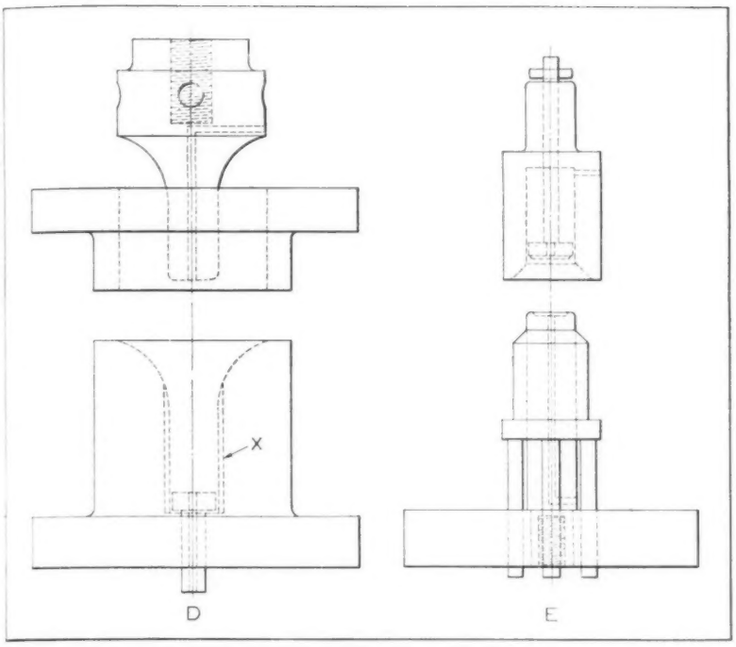


Fig. 6. (D) Die Used for Fourth Operation on Shells C, Figs. 1 and 2. (E) Die that Produces Shells E, Figs. 1 and 2

The second type of shell made in the same set of dies must be formed to a slightly larger diameter—2.125 inches. The shell produced in this operation is shown at *C*, Fig. 2. It has a height of 3 7/8 inches, and is drawn to the same depth in the first and second operations as shell *C*, Fig. 1.

The fourth operation on both types of shells is performed in the die shown in Fig. 5, and at *D*, Fig. 6. The die and blank-holder are cast iron, and the punch is cold-rolled steel. The small portion of the die member is 2.185 inches in diameter, and will accommodate the larger of the two shells. A sleeve *X*, Fig. 6, of cold-rolled steel which is a slip fit in the die is used to center the smaller of the shells. As this operation consists only of forming the flared part of the shell having the 45-degree angle, the same punch is used on both the larger and the smaller shells. The length of the punch is such that it does not hit the bottom of either shell. The two kinds of shells made in this die are shown at *D*, Figs. 1 and 2.

At *E*, Fig. 6, is shown the die used for further reduction of both types of shells, as indicated at *E*, Figs. 1 and 2. This die is used in a single-action press having a 5-inch stroke. The reduced part of the shell is 2 1/4 inches long, the diameter being 1.675 inches for both types of shells. A different pressure ring is used for the two sizes of shells.

The next operation on both types of shells is trimming, an ordinary blanking die 4 1/4 inches in diameter being used with a centralizing pilot on the punch. These shells are used as reflectors for indirect lighting lamps; such additional operations as piercing holes for assembling and for the socket key are performed by the use of ordinary equipment.

The second type of shell *F*, Fig. 2, after being trimmed, is put through a novel rolling operation which produces the beading shown. This beading is formed on a trimming and beading lathe with the equipment seen in Fig. 7. As the chuck is smaller than the shell at the point where the beading roller is applied, the pressure of the roller re-forms the shell to correspond with the shape of the roller. The lathe is run at a speed of 800 revolutions per minute for the rolling operation.

In Fig. 8, the shell is shown in place on the chuck, where it is held in position by the tailstock block. The tailstock block is a formed wood block held in a ball-bearing chuck so that it can revolve freely with the shell. The shell shown on the chuck has been formed by bringing the roller forward through the operation of a lever. The time required for the rolling operation is about two seconds a piece. This operation reduces the diameter 0.200 inch and forms the bead to a radius of 11/32 inch.

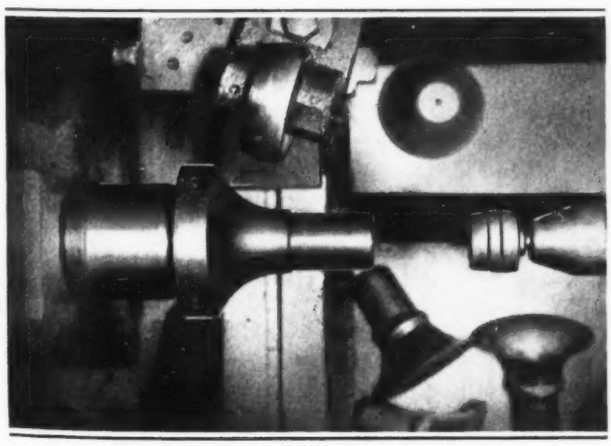


Fig. 7. Set-up on Trimming and Beading Lathe Used to Roll Bead on Shell F, Fig. 2

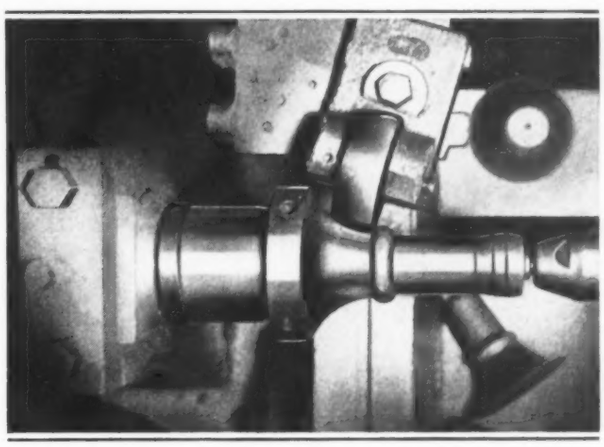


Fig. 8. Completion of Bead-rolling Operation with Set-up Shown in Fig. 7

Engineering News Flashes

The World Over

Stainless Steel is Real Money in Italy

Coins of the smaller denominations produced by Italian mints during 1939 will last indefinitely and will always have a high luster, because they were made of stainless steel. According to the *Electromet Review*, published by the Electro Metallurgical Co., New York City, 16,500,000 pounds of stainless steel were used for this purpose. The alloy contained about 22 per cent chromium, 12 per cent nickel, and a small amount of molybdenum.

The coins were minted in denominations of 2 lire, 1 lira, and 50 and 20 centesimi. On one side of each coin is the design of the Fascisti eagle, and on the other a likeness of King Vittorio Emanuele. These impressions will be distinguishable for many years.

New Type of Leather Belting Made up from Links

A new type of leather belting has been placed on the market by Alexander Brothers, 406 N. Third St., Philadelphia, Pa. In this belt, leather sections are used as links. Each link is made of two plies of leather, providing a strong link that wears evenly with a minimum of stretch and likelihood of breakage. The flesh or rough sides of the single links are bonded together, producing a solid link with the smooth or grain side of the leather on the outside. The double-ply links are drilled and joined together with steel connecting pins. The great flexibility of this construction permits of efficient transmission of power, because of the greater pulley grip maintained. The belt operates efficiently on comparatively small pulleys, and, with the use of an idler, at relatively short center distances. This type of belt is intended for slow, heavy pull drives, such as on paper mill winders and similar applications.

Heating and Cooling by Air Drawn out of the Ground

At the Swiss National Exhibition held at Zurich last summer, equipment was exhibited for drawing cool air out of the earth by means of a fan, for ventilating shop buildings. During winter, these fans may be used for drawing air from the earth for heating purposes, as for example, in garages, where heating in the ordinary sense of the word is not necessary, but where the temperature of the air must be kept from becoming too low. The equipment consists of a simple fan which draws the air from a moderate depth underground and discharges it into the rooms to be heated or cooled. Heating by this equipment is possible, because the temperature of the air drawn from the earth is seldom less than 50 or 60 degrees F.; and for cooling purposes in the summer, it is equally useful, since the air drawn from the earth is then almost as cool as in the winter.

Cast Aluminum Rotors Now Made for Large Induction Motors

Offering the advantage of longer motor life, combined with lower maintenance cost, a new type rotor construction announced by the General Electric Co. makes possible the use of cast-aluminum rotors in the larger sizes of double squirrel-cage motors for high starting-torque, low starting-current service. The new "Valv-amp" rotor makes use of a unique shape of rotor slot and a special method of assembling rotor punchings to control the flow of starting current. As a result, without the use of a switch or other moving parts, current is allowed to flow into the outer squirrel cage when the motor is started, thus producing high starting torque. Then, when the motor comes up to speed, current is allowed to flow through the entire rotor winding. This arrangement results in excellent running characteristics.

Unusually Strong Alloy with Low Iron Content

A new alloy, designated K-42-B, has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., which contains only 7 per cent of iron, and yet is stronger than any known steel. It is stronger at 1100 degrees F. than ordinary low-carbon steel at room temperature, and retains its full strength at temperatures up to 2200 degrees F. It has a low damping coefficient and creeps a great deal less than other alloys in its class. Sample rods loaded in tension at 20,000 pounds per square inch when heated to 1000 degrees F. showed a yield of only 0.0001 inch per

inch at the end of 6000 hours. Under similar conditions, high-strength nickel-chromium steel yielded one hundred times as much. The composition of this new alloy is about one-half nickel and one-quarter cobalt, the remainder being made up of chromium, titanium, iron, manganese, aluminum, silicon, and carbon. The new alloy is not yet available as a commercial product.

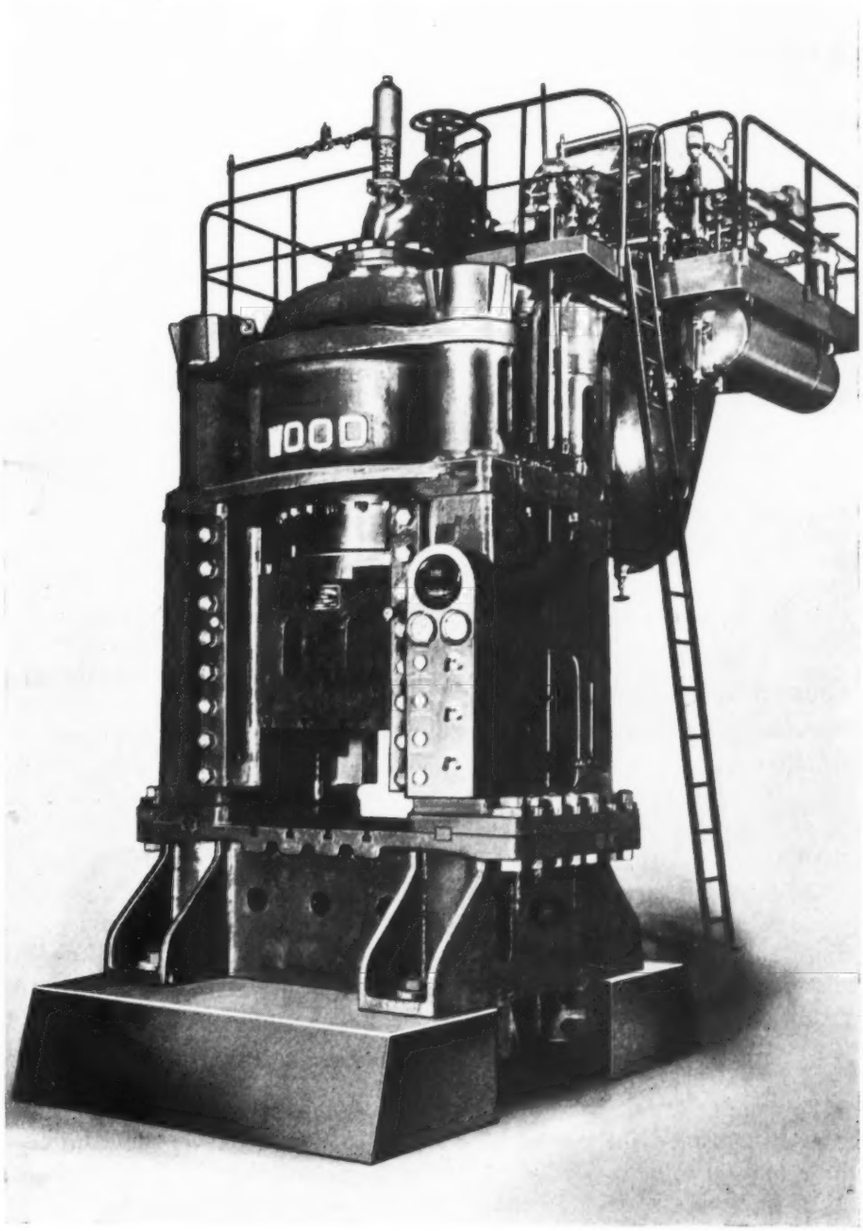
The Largest Plastic Molding Ever Produced

Indicative of the trend toward larger and larger molded articles is the fabrication of coffins from molded plastics. This development, which originated in England, was described by C. A. Norris, of the Bakelite Corporation, in an address presented before the Franklin Institute. A special press with a 42-inch main ram and two 15-inch pull-backs was built to handle this class of work. The unit is rated at 4000 tons with a pressure of 5000 pounds per square inch. The mold is so constructed as to permit the insertion of extra pieces in the chase and force plug, so that the length of the molded coffin can be varied. The ends and sides of the chase are movable and actuated by wedges which, in turn, are moved by horizontal rams.

Seventy pounds of phenolic material in the form of large chips, averaging about 3 inches long and 1/8 inch thick, are used for the mold charge, which is preheated and carefully distributed in the mold. The mold closing time is approximately sixty seconds, and the time required for polymerization of this piece, which is the largest molding so far produced, is eight minutes.

New Process for Applying Silver Coatings

A new process by means of which silver platings 0.0002 to 0.001 inch thick can be quickly and economically applied has been developed by the Rapid Electroplating Process, 1414 S. Wabash Ave., Chicago, Ill. The important uses of the new development are said to be in the spot application of adherent silver platings to bus-bars and to bolted, threaded, or friction connections for high- or low-voltage circuits, where reduction of resistance and consequent improvement of conductivity are important. Fundamentally, the process does not differ from ordinary commercial plating methods except that the liquid electrolyte is replaced by a concentrated jelly-like compound which, owing to its consistency, can be picked up by a specially designed brush and applied to the desired surface.



A 2000-ton Forging Press, Built by the R. D. Wood Co., Having a Ram 45 Inches in Diameter, 4 Feet 6 Inches Long, and Weighing 16,000 Pounds. The Ram is Cast from Meehanite Metal to Provide the Necessary Strength for High-speed, High-pressure Action. The Four Ram Guide Plates are Made from the Same Material. The Operation of the Machine is Entirely Automatic, Controlled by a Push-button Panel

EDITORIAL COMMENT

Sometimes the charges made against the machine are so silly and childish that they would cause only amusement if it were not for the fact that they come from men of high standing in the community. For example, Dr. John J. Tigert, president of the University of Florida, in a recent address, alleged that the machine has not only been the cause of unemployment, but also has tended to disrupt American home life, increased crime and impaired morals, destroyed personality and cultural accomplishments, and incited to war. As far as one can judge, there is hardly any evil in the world for which the machine cannot be blamed.

Now the Machine is Guilty of Destroying Priceless Violins

But, when in all seriousness, Dr. Tigert blames the machine for the destruction of a seventeenth century priceless violin, simply because a young man standing on the sidewalk dropped the violin case in the street just as a truck was passing, his argument becomes somewhat ridiculous. As a matter of fact, the hoof of a horse in the horse-and-buggy days would have been just as effective in crushing the violin as a modern truck.

It is a serious matter, however, when an educator of Dr. Tigert's standing gives evidence of such profound ignorance of the relation of the machine to our civilization; for Dr. Tigert is not a man without an impressive background. According to our information, he has held such positions as U. S. Commissioner of Education, chairman of the Federal Council on Citizenship Training, vice-chairman of the Federal Board for Vocational Education, and president of the Association of Colleges and Universities of Kentucky. When a man of such qualifications is capable of drawing such erroneous conclusions, what can be expected from the ordinary politician, parlor sociologist, labor leader, and the great mass of people who accept their opinions ready-made from "blind leaders of the blind."

How to Correct Misinformation is a Job for Industry

We wonder if Dr. Tigert is consistent enough to have discouraged the use of all machines and machine-made products within the educational institution of which he is the head. If he has, that institution should offer one of the most interesting and valuable object lessons of what life in these United States would be like without machines.

The article in this number of MACHINERY, beginning on page 108, on the continued training and trade education of men already in a company's employ, opens up a subject of vital importance. This is a phase of trade training that has been given little or no attention in the past. Many industrial organizations have excellent means for training apprentices, as well as for training young college graduates to fill executive positions. So-called "vestibule schools" are also maintained which train a man in a short period of time to operate some particular type of machine or to handle some specific jobs for which all-around skill is not required.

Continued Training for the Man Already Trained

The worker already engaged in industry, however, has been left to shift for himself. What has been done at the Monarch Machine Tool Co., as outlined in the article referred to, is, therefore, of unusual interest. Supplementary trade education and training is certain to be of benefit both to these men and to the organization for which they work, and better employe relations are promoted.

The idea of educational facilities for men already employed suggests even broader possibilities. In one instance, at least, classes or "conferences" are being conducted for the purpose of giving the men and women employed by the company an understanding of industrial economics. In these days, when erroneous, or but partly understood, economic ideas are being preached, it is of particular value that some responsible agency should undertake to clearly explain to those working in an industry how that industry operates, what economic factors are involved, and how the successful operation of industry means better living conditions for everyone concerned. The events of recent years indicate that it is necessary for industry to take the initiative in formulating correct conceptions among workers and the public at large with regard to industry's real place in the well-being of the entire population.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Reversing Mechanism for Chain-Driven Table

By L. KASPER

The accompanying diagrams illustrate the operation of a table reversing mechanism designed for use on a wire fabricating machine in which the table is driven by a roller chain. As shown in the diagrams, the table is reversed or reciprocated by alternately disengaging and engaging the upper and lower portions of the driving chain at opposite sides of the sprockets. The mechanism, while not applicable to very heavy drives, possesses the advantages of simplicity and the ability to function when long table traversing movements are necessary. A front elevation of the machine and an end view on section *XX* are shown diagrammatically in Fig. 1. The table *A* is reciprocated by the chain *B*, its length of travel being controlled by the positions of the adjustable dogs *C* and *D*.

Referring to Figs. 2, 3, and 4, the vertical slide *E* is carried between two blocks *F* and *G*, which are attached to a supporting member *H*, Fig. 1. Blocks *F* and *G* are grooved to carry the horizontal slide built up of the plates *I* and *J*, which are spaced to accommodate springs *U* and *V*, as well as the levers *Q* and *R*. Plates *I* and *J* are held together by rivets. The plates *K* and *L* retain the horizontal slide in the blocks *F* and *G*.

Vertical slide *E* is grooved to permit the horizontal slide to pass freely through it, and carries at its upper and lower ends the toothed dogs *M* and *N*, which are shaped like the teeth of a standard roller-chain sprocket. These toothed sections are alternately inserted between the rollers of the chain, and serve to transmit the movement of the chain to the table *A*. The chain *B* is supported by the guide blocks *O* and *P*, which are attached to the supporting member *H*, Fig. 1, and therefore travel with the table *A*. The levers *Q* and *R* are supported freely on pins between plates *I* and *J* of the horizontal slide, and are normally held in contact with the pins *S* and *T* by the springs *U* and *V*. The pin *W*, carried by the horizontal slide, serves to operate the mechanism when it comes in contact with the adjustable dogs *C* and *D*. It will be noted, by referring to Fig. 3, that lever *Q* projects out of the horizontal slide into the widened groove in the vertical slide *E*, while lever *R* projects into the recess formed in block *G*.

Fig. 3 shows the mechanism in the normal driving position, the teeth of dog *N* being engaged between the rollers of chain *B*, which is supported at that point by the guide *P*. Dog *N* cannot be disengaged from chain *B*, as the position of lever *Q* prevents slide *E* from moving in its groove. As that side of chain *B* into which the teeth of the dog *N* are engaged is moving in the direction indicated by the arrow, table *A* is caused to travel with it to the right until pin *W* makes contact with the fixed dog *C*. This restrains the horizontal slide from further movement with the assembly.

Continued movement of table *A* causes lever *R* to be turned on its pivot pin and enter the groove in slide *E*, as shown in Fig. 5. In this view, plates *K*, *L*, and *J* have been removed and the positions of pin *W* and dog *C* are shown by dotted lines. Lever *R* is shown held against the upper edge of the groove in slide *E* by the increased tension of spring *V* produced by the swinging movement of lever *R*. However, no movement of slide *E* takes

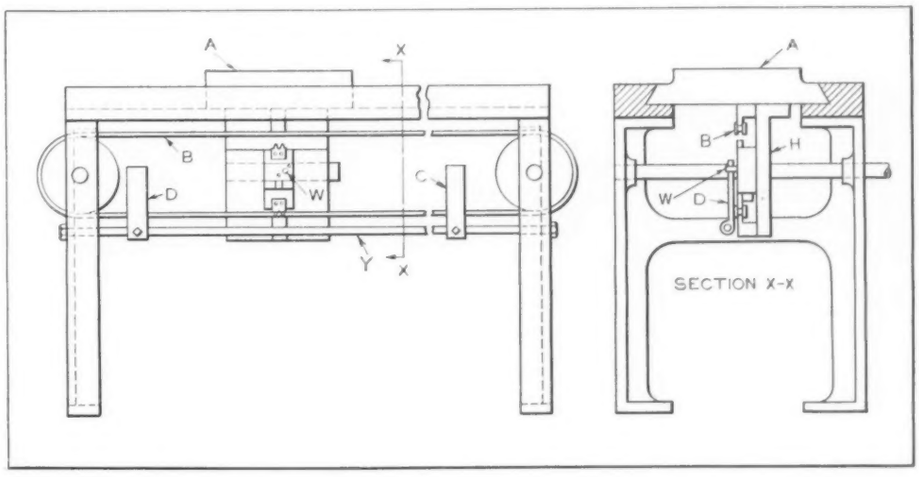


Fig. 1. Diagrams Showing Arrangement of Chain-driven Table Reciprocating Mechanism

place, as it is still locked in place by lever *Q*. Further movement of the table causes lever *Q* to pass beyond the lower edge of the groove in slide *E*, at which time the tension of spring *V*, acting against the upper edge of the groove in slide *E* through the lever *R*, causes slide *E* to be raised quickly to the position shown by the dotted lines. The teeth of dog *M* entering between the rollers of the upper length of chain *B* carry the table in the opposite direction, or to the left.

Table *A* continues its movement to the left until pin *W* comes in contact with dog *D*, locked in position on the bar *Y*, Fig. 1. At this time, lever *Q* acts on slide *E*, again bringing about the engagement of dog *N* with the lower part of chain *B*. This causes table *A* to move to the right again.

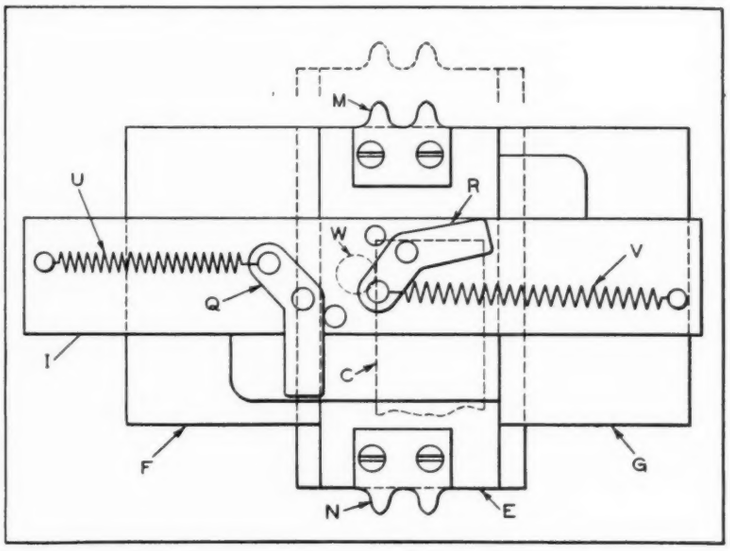


Fig. 5. Table Reversing Mechanism that Serves to Raise Slide E to Position Shown by Dotted Lines

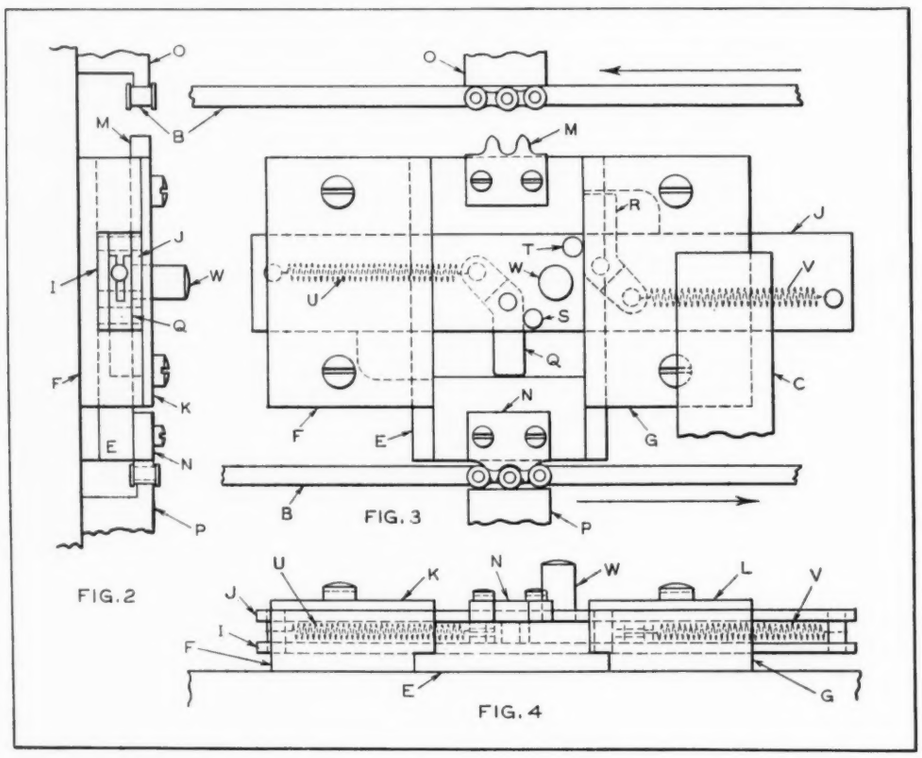
* * *

According to the Bureau of the Census, taxes collected by the various states for 1939 were 18.5 per cent greater than in 1937. The operating costs of the 48 state governments rose from $380,000,000 in 1915 to $2,600,000,000 in 1937. The per capita cost of state government rose from about $20 per person in 1912 to $77 per person in 1932. The cost of the federal government, as we know, has risen in a much greater ratio than this in recent years.

Present Unemployment is Partly Due to Governmental Mistakes

Neither labor nor capital can afford to accept the concept that it is inevitable that we maintain a constant army of unemployed in this country. Both must work together to demonstrate the fallacy of this doctrine of defeatism. Both must work together to encourage private enterprise, and thus stimulate private employment to the maximum. Both must work together to afford those in Government the best possible cooperation and advice in the passage and administration of measures which will enable America to recapture its former high standard of living and rapid rate of national progress.

The National Association of Manufacturers will not rest until the iniquities and injustices of the National Labor Relations Act and its administration are corrected. They constitute the greatest single drawback to industrial peace and to full recovery.—*Howard Coonley in his annual report as president of the National Association of Manufacturers*



Figs. 2, 3, and 4. Diagrams Illustrating Operation of Mechanism for Reversing Table Drive

Flame-Hardening and Hard-Surfacing

A Review of the Principles Involved in These New Surface-Hardening Methods, Together with Directions for Selecting Hard-Surfacing Materials

WHEREVER there is the problem of excessive wear due to scraping or cutting action, seizing, or galling, the application of flame-hardening or hard-surfacing methods may be found to offer an effective solution. As outlined by C. E. MacQuigg, dean of the College of Engineering, Ohio State University, Columbus, Ohio, in an address before the International Acetylene Association, methods that provide hard wearing surfaces on machined parts and still leave the interior metal in a relatively ductile state are receiving increasing attention.

Advantages of Flame-Hardening

Flame-hardening is a process accomplished by the rapid raising of surface temperature through the local application of intense heat, followed by rapid cooling. Its advantages include: (1) No change of chemical composition in the hardened surface. (2) Easy application to limited areas. (3) Possibility of increased hardness, due to the rapid quenching action possible because of the large volume of cold metal beneath the heated surface. (4) Low stresses between the hard surface and the relatively ductile core; this prevents spalling or "shelling out." (5) Feasibility of application to sections as thin as 1/4 inch or even thinner, with proper technique. (6) Scale-free surfaces, due to rapidity of treatment.

Flame-Hardening Methods

The heating operations of flame-hardening may be classified as stationary, progressive, and spinning. In the stationary procedure, sometimes called "spot-hardening," both torch and work are motionless during the operation. With the progressive method, the flame and work are moved relative to each other, and the metal is quenched immediately after it is brought up to temperature. Thus, in flame-hardening a plane surface, the lighted oxy-acetylene torch is directed along the surface at the maximum speed that will permit heating the surface zone above the critical point of the steel, while immediately behind the flame is a stream or spray of water which progressively quenches the heated surface. The speed is determined by operating variables, such as flame intensity, type of steel under treatment, and temperature desired. The usual speeds are from 6 to 8 inches per minute, although the range may extend from 4 to 10 inches per minute.

In the spinning method, principally applied to round parts, the torch is stationary and the work is rotated before the flame. When the entire area has reached the hardening temperature, the quench is applied, with the work still rotating. The time for hardening by this method varies from a few seconds to two or three minutes.

For quenching, many devices can be used, ranging from a small stream of water from a round nozzle to a carefully designed spray nozzle. Spinning operations are better controlled by quenching with a large volume of water under low head, which simulates total immersion. Certain steels, too sensitive to be quenched with water, may be treated with a soap-water solution or a soluble cutting oil in water. If machine tools are used in flame-hardening, the cutting oil systems can be used for quenching.

As a rule, flame-hardening operations should be followed immediately by a low-temperature draw to relieve quenching stresses; this can be conveniently done in an oil bath or oven. Although generally recommended, the drawing operation is not always necessary, since by carefully controlling the quantity and application of the quenching medium or by delaying its application, the operation becomes "self-drawing."

Owing to the fact that flame-hardening is adaptable to complicated parts with less danger of distortion or other faults than other heat-treating methods, it finds important use in the treatment of rail ends, pump liners, crane wheels, gears, tractor shoes, sheave wheels, machine ways, valves, crankshafts and camshafts, and many other parts.

However, flame-hardening should not be considered a universal method adaptable to any occasions where surface hardening is required. It may be more economical, for example, to harden a large number of small parts in a batch by means of case-carburizing or nitriding. Flame-hardening, as such, is not just a matter of purchasing the required hardening equipment, but is a specific process with advantages and disadvantages that should be thoroughly investigated before it is adopted in place of other heat-treating methods.

Steels Suitable for Flame-Hardening

In selecting a suitable steel for flame-hardening, it may be said that plain carbon steels can be hardened satisfactorily by this process, provided the carbon content is more than 0.40 per cent. The upper limit of carbon is dependent upon the method

Table 1. Steels Suitable for Flame-Hardening and Degree of Hardness Obtained

Flame-Hardening Steels	Case Hardness*	
	Scleroscope	Brinell
S A E 1035-1070	50–90	350–700
S A E T1335-T1345	75–90	550–700
S A E 2340-2350	70–80	500–600
S A E 4140-4150	70–85	500–650
S A E 4640	70–80	500–600
S A E 5140-5150	70–85	500–650
S A E 6135-6150	75–85	550–650
Carbon-Vanadium	70–90	500–700
Cromansil	75–85	550–650
Manganese-Molybdenum	75–85	550–650

*Hardness determinations on flame-hardened parts should preferably be made with the scleroscope. The Brinell numbers given here have been converted. The hardness figures are for water-quenched materials.

of hardening used, but steels having a carbon content up to 0.70 per cent or even higher, depending upon the sections, can be successfully flame-hardened. Alloy steels of a wide range of compositions can be satisfactorily treated by this process, but in general, because of economic factors, its application is restricted to the low or medium alloy types, that is, those in which the percentage of the principal added elements is small. Some of the steels to which flame-hardening has been successfully applied and the degree of hardness obtained are listed in Table 1.

Alloys Used in Hard-Surfacing or Hard-Facing

Hard-surfacing or "hard-facing"—a process of comparatively recent development—consists in welding to wearing parts a facing, edge, or point of hard metal which is exceptionally resistant to abrasion. By this method, metal surfaces that normally wear away rapidly in service receive adequate protection from the added layer of wear-resistant alloy. To meet the various requirements of hardness, toughness, shock resistance, etc., many hard-facing alloys of widely different compositions have been developed. These may be divided into four broad groups: (1) Low-alloy steels; (2) high-alloy steels; (3) non-ferrous alloys; and (4) tungsten carbides and borides.

Group 1—Low-Alloy Steels—No sharp definition of composition. Alloying constituents usually less than 5 per cent, but may extend almost to 10 per cent. Not as wear-resistant as the other groups, but have some advantage in toughness and shock-resistance. Manganese, chromium, molybdenum, vanadium, and tungsten are common alloying elements, generally with about 0.3 to 0.6 per cent of carbon.

Group 2—High-Alloy Steels—Alloying elements in excess of 10 per cent. Almost invariably contain high-chromium for extra wear-resistance. Manganese, cobalt, tungsten, and nickel may also be present. Somewhat more expensive than Group 1, but have markedly greater wear-resistance which may make for greater economy in the long run.

Group 3—Non-Ferrous Alloys—Cobalt, chromium, and tungsten are usually the alloying elements. Highly resistant to wear, with a range of different grades having a spread in strength and toughness which makes them suitable for a large number of hard-facing applications. Because of non-ferrous composition, original hardness is practically unimpaired at elevated temperatures.

Group 4—Tungsten Carbides—The so-called diamond substitutes, which are the hardest and most wear-resistant of all hard-facing materials. Some are almost pure fused tungsten carbides; others contain 90 to 95 per cent tungsten carbide, with the remainder usually cobalt, nickel, or iron. Generally furnished in the form of small castings, known as inserts, or as welding rods, in which the hard particles are packed in steel tubes. Because of their extreme refractoriness, these compounds are not melted or otherwise greatly affected by the oxy-acetylene flame. They are "wetted" by the molten metals and become fused in place—much as a lump of tinned steel might be soldered to a piece of copper. Thus they are held in place without difficulty.

Table 2 indicates how materials from each of these groups may be selected to meet specific requirements. For example, for resistance to impact, the alloys in Group 1 are first choice.

Materials that can be Hard-Faced

All plain carbon and low-alloy steels can be processed by this method, provided the carbon content is not substantially in excess of 0.5 per cent. Steels having higher carbon and alloy contents require, under some circumstances, special heat-treatments subsequent to the surfacing operation, and a preheating of the part to be surfaced may even be required. Gray cast iron and alloy cast iron are readily hard-surfaced. On the other hand, brass, copper, or bronze cannot be hard-surfaced because of their relatively low melting points.

During the past few years there has been a definite trend toward the use of hard-faced seating surfaces for refinery valves, where operating conditions require that seat and disk material be free

Table 2. Guide to Selection of Hard-Facing Alloy

Characteristic of Deposit	Group Number			
	First Choice	Second Choice	Third Choice	Fourth Choice
Cold-Hardness	4	2	3	1
Red-Hardness	4	3	2	1
Resistance to Impact	1	2	3	4
Corrosion-Resistance	3	2	1	4
Smoothness of Deposit	3	1	2	4
Ability to Scour	4	2	3	1
Thinness of Welding	3	2	1	4

from seizing and galling, and at the same time be corrosion-resistant. Hard-faced valves have proved particularly dependable for handling high-temperature, high-pressure steam, as well as for handling hot, high-sulphur crudes containing free sulphur-dioxide and sulphur-trioxide. Valves so treated are free from scoring and wire-drawing, remain tight, and insure leak-proof dependable performance.

Probably the most outstanding example of the use of hard-facing material in the automotive field is for armoring exhaust-valve seats. Most of the manufacturers of heavy-duty trucks and buses have standardized on hard-faced exhaust-valve seat inserts, because these seats last longer, require less attention, and reduce valve grinding and adjustment to a minimum.

There is hardly a single piece of machinery used in the building and maintenance of roads that will not operate more efficiently and economically when hard-faced at wear-exposed points. Road-scraper blades, sub-grader blades, scarifier teeth, plows, tractor treads, crushing machinery, and tar scrapers for the seams of concrete roads are all hard-faced, with considerable improvement in operating efficiency. Other applications include steel mill shear blades, lumber mill shredder knives, and coal undercutter bits. These examples illustrate the variety of parts to which this process is applicable.

* * *

The Aero-Thread—A New Method of Making Threaded Connections

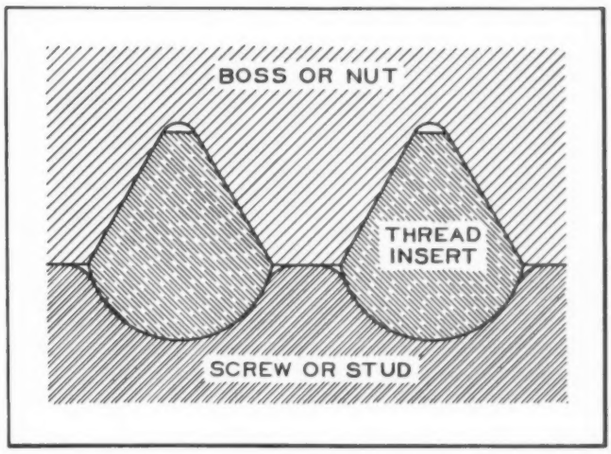
What might be termed a new screw-thread system has been developed by the Aircraft Screw Products Co., Inc., 25-12 Forty-first Ave., Long Island City, N. Y. A number of companies, especially aircraft manufacturers, have been licensed to use the new thread system, which is known by the trade name "Aero-Thread."

The principle involved in the system can be best understood by reference to the accompanying illustration. The part containing the female thread, or nut, is threaded with a 60-degree thread, as usual. The screw, or stud, is provided with a semicircular thread form, as shown. Between the screw and the nut there is an intermediary part known as a thread lining or insert, which is made in the form of a helical spring, so that it can be screwed into the nut. The stud, in turn, is then screwed into the thread formed by the semicircular part of the thread insert.

This unusual construction is especially applicable in cases where the nut is made from a soft material, such as aluminum or magnesium alloy, for the sake of obtaining lightness, as in aircraft construction, and where the screw is made from a high-strength steel to provide strength and good wearing qualities. When the screw is provided with a V-thread, as in the usual design, frequent loosening and tightening of the screw would cause rapid wear of the softer metal from which the nut is made. Furthermore, all the threads might not have an even bearing on the mating threads.

By using a thread insert which is screwed into the nut once and for all, and which is usually made from a reasonably hard material of good wearing qualities, like bronze, a smooth thread engagement is obtained. Also, the load is evenly distributed over all the threads of the nut since, obviously, the insert, being in the form of a spring, can adjust itself to bear evenly on all the threads.

While it is true that the semicircular thread groove has only about half the shear resistance of the V-thread groove, this is of no consequence in a case where the screw and thread insert are of a high-strength material, as compared with the nut, since the semicircular thread in the insert and the screw will have fully the strength of the V-thread in the softer and weaker material from which the nut is made. Furthermore, the semicircular thread



The Basic Thread Forms Used in the Aero-Thread Screw System

form prevents fatigue cracks from starting in the screw. Experience has indicated that the forming of fatigue cracks in the base of the V-groove in the nut may also be prevented, doubtless because the thread insert distributes the load over all the threads in engagement and thereby prevents high stresses in one or a few threads.

* * *

According to R. S. Kersh, of the Westinghouse Electric & Mfg. Co., as stated in a paper read before the Metropolitan Section of the American Society of Mechanical Engineers on the subject "Electrical Improvements for Machine Tools," one of the leading builders of general-purpose machine tools estimates that ten years ago only 40 per cent of the machines of his manufacture were ordered with individually applied motors. Today, over 90 per cent of the machines that he builds are motorized, and practically all newly designed machines are arranged for direct electric drive and control.

Die Design for Inclinable Presses

A Review of the Principles Involved in Designing Dies for Inclinable Presses so as to Insure Maximum Production and Safety of Operation
Second of Two Articles

By JOSEPH I. KARASH
Tool Design Department
Reliance Electric & Engineering Co.
Cleveland, Ohio

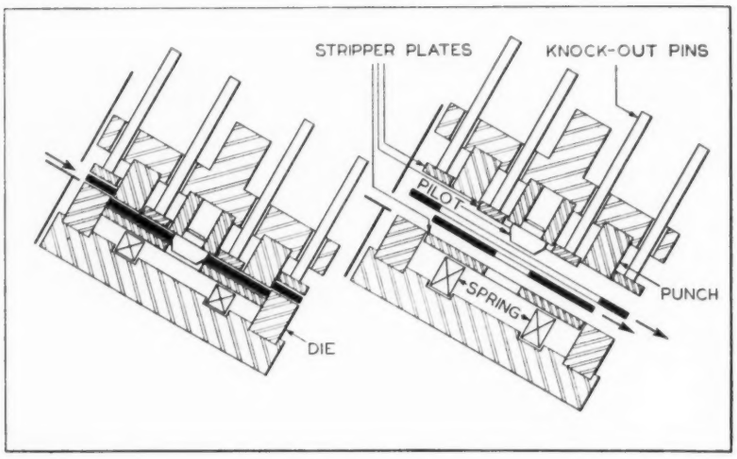


Fig. 6. A Separating Die Intended for Secondary Operations on Semi-finished Stock

IN the first installment of this article, published in May MACHINERY, page 106, the simplest type of self-unloading die used in an inclinable press was described, the application of knock-out pins was referred to, and the inverted type, as well as a simple form of compound die, was illustrated. The present installment will deal with the design of separating dies, stripper-plate suspension for knock-out pins, spring-operated stripper plates, and die design for making simple V-bends.

Design of Separating Die

In Fig. 6 is shown a separating die. This design is intended for secondary operations—that is, operations on a semi-finished unit stock, which must be accurately punched or blanked in relation to a hole, or holes, already in the piece. This type of operation is often met with in the electrical industry, as for example, in separating the stator and rotor laminations of an electric motor, using the shaft hole as a locating point.

The operation of this die is unusual in many respects. If possible, the semi-finished blank should be fed to the die set by a gravity chute, the stock coming to a stop slightly beyond the correct position for blanking. This is to prevent pinching the stock against the stop-pins when the locating pilot is in place. As the ram descends, the pilot enters the hole in the blank and accurately locates the piece. There is a hole in the bottom stripper plate for the pilot to pass through. As the ram continues to descend, the punch cuts the stock into two concentric rings. The inner ring is forced down into the die, and the outer ring is forced up on the punch.

As the ram starts up, the bottom stripper plate forces the inner ring up out of the die. However, since the pilot is a tight fit in the locating hole, the inner ring clings to it and continues to go up with the ram. A stripper plate is provided in the upper member to strip the inner ring from the pilot. This stripper plate is actuated by the two inner knock-out pins, and the stripping, of course, takes place at the top of the ram stroke.

The stop-pins in the lower member should be located so that the falling inner ring can slide between them and pass out through the throat of the press. The fall from the top of the ram stroke to the die-block should give the inner ring enough of a start to prevent it from clinging to the die. This automatically disposes of the inner ring.

The outer ring, as previously mentioned, has been forced up on the punch, to which it clings until stripped at the top of the ram stroke by the knock-out pin actuated stripper plate. From this elevation, the leading edge of the outer ring will clear the stop-pins. The piece will then slide over the pins and out through the throat of the press.

It is advisable to make the knock-out pins for stripping the center ring approximately 1/4 inch longer than those used for the outer ring. Thus, the inner ring is stripped first and interference of the pieces is avoided. The material-handling time has been practically eliminated, because the loading can be done during the up stroke and the start of the down stroke of the ram.

As will be noted, both pieces produced by this operation pass out through the back of the die. The two pieces can be automatically made to fall into separate boxes by using a separating chute, made of sheet metal, into which a hole is cut of such a size that the smaller ring will fall through it into a container, while the larger ring will slide over it and fall into another box. In this way, the manual sorting of the blanks can be eliminated. As previ-

ously mentioned, entanglement of the two pieces can be avoided by making the inner knock-out pins slightly longer than the outer ones.

Stripper-Plate Suspension for Knock-Out Pins

Fig. 7 illustrates the suspension of the knock-out pin actuated stripper plate. In some respects, this suspension is different from that of the conventional spring-operated stripper plate. The springs used with the knock-out pin operated stripper plate are comparatively light, and are used to counteract the weight of the stripper plate itself and to prevent the inertia of the plate from prematurely stripping the stock. The down and up motion of the ram produces more or less of a whip-like change of direction. Because of this, the inertia of the stripper plate would, in many cases, strip the stock. This is particularly true where the material is of light gage. The disadvantage of having the stock prematurely stripped is that the material would be left lying on the die and be unable to slide over the stop-pins. In order for the stock to go over the stop-pins, it must be stripped at the top of the ram stroke.

The suspension of the stripper plate shown in Fig. 7 has some indirect advantages over the spring-actuated type of stripper plate shown in Fig. 8. In the latter type, the stripper plate must be removed in order to grind the die. With the stripper plate suspension shown in Fig. 7, it is unnecessary to remove the stripper plate, because it is normally in the retracted position. In order to grind the die, it is only necessary to slip out the knock-out pins.

With the spring-actuated stripper plate shown in Fig. 8, it is necessary to adjust the stripper plate from time to time as the die wears. This is usually done by substituting shorter stripper bolts or by placing washers under the stripper-bolt heads. With the stripper-plate suspension shown in Fig. 7, adjustment is not necessary during the life of the die. The setting of the stripper plate is easily taken care of by the adjustable bar that actuates the knock-out pins.

In cases where no guide posts are used, a die set with the stripper plate shown in Fig. 8 is hard to set up, because the stripper plate prevents the punch from entering the die to establish alignment. With the knock-out pin type of stripper plate, the stripper plate is in a retracted position and there is no difficulty in entering the punch into the die. This greatly simplifies the set-up.

With the spring-actuated stripper plate, Fig. 8, the stripper plate acts as a pressure pad. Sometimes this is undesirable—for example, where it is necessary to have a pilot in the punch-holder. With the spring-actuated stripper plate, the plate would project beyond the holding point on the pilot; this would prevent the pilot from moving the stock into position. Operation of dies such as shown in Fig. 6 would not be possible unless the knock-out pin actuated stripper plate were used.

In the designs thus far shown, variations of each type have been avoided. Each design has shown some fundamental principle adaptable to inclinable press dies. It will be noted that, wherever possible, the blank has been punched through the die. In some cases, it is not practical to do this, because the die set is greatly weakened if a large hole is cut through it for a large blank to pass through. Another reason for not passing the blank through the die is that the die would have to be ground for taper, in order to allow the blank to pass through the die ring. As the die wears, there would be a noticeable burr and a slightly larger blank.

If a spring-actuated stripper plate such as shown in Fig. 9 is used in the die, the sides of the die can be perpendicular and will produce the same size punching throughout the life of the die without increasing the burr or size of blank. Since this will be used in an inclinable press, provision must be made to eject the material from the die ring, and the die set must also be designed so that the blank will slide out of it.

It will be noted that there is a slot cut in the stripper plate and a spring secured in the slot.

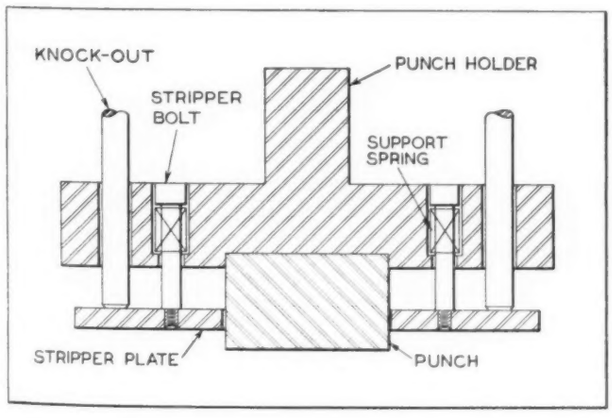


Fig. 7. Diagrammatic View Showing the Suspension of a Knock-out Pin Actuated Stripper Plate

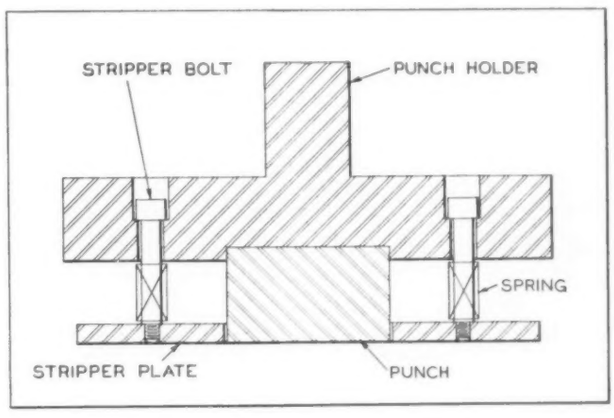


Fig. 8. Diagrammatic View Showing the Suspension of a Spring-operated Stripper Plate

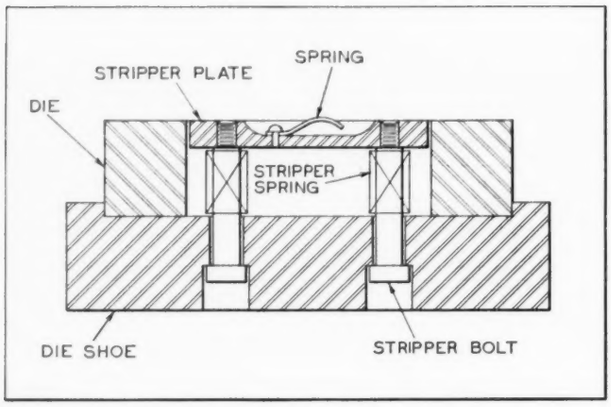


Fig. 9. Another Arrangement of Spring-operated Stripper Plate

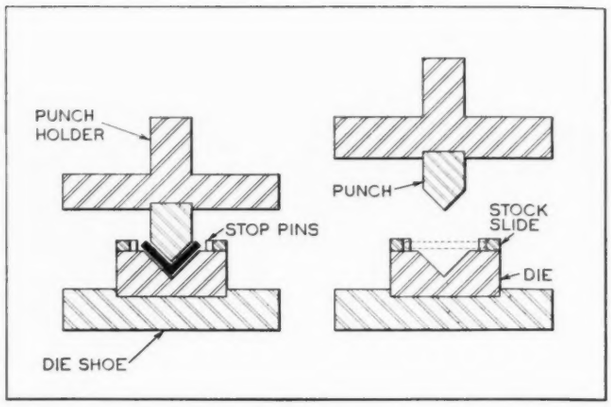


Fig. 10. Diagrammatic Views of a Bending Die for Simple V-bends

When the stock is entered in the die set, the material slides over the spring and comes to position against the stop-pins. Then when the punch descends and punches the blank, the blank is forced down into the die. Upon the upward stroke of the ram, the springs behind the stripper plate force the blank up out of the die. However, there is a tendency for the blank to cling to the stripper plate, due to a very small burr around the edge of the blank. This is overcome by the action of the spring on top of the stripper plate, which lifts the blank free, so that it can slide out of the die set.

It is important to arrange the stop-pins so that the blank can slide between them and out of the press, but they should be so arranged that the outside piece is held until punched. Any of the knockout pin stripping schemes can dispose of the outside piece. The blank, when stripped with a spring-actuated stripper plate, must slide across the die and out of the press, and must not be held by the stop-pins.

This method of disposing of the blank, as shown in Fig. 9, should be carefully kept in mind. In all the dies shown, where the blank passes through the die ring, this type of stripper plate can be used to force the blank out of the die. In the case of compound dies such as shown in Fig. 5 (see May MACHINERY, page 108) the blank would slide not only over the die ring, but also over the outside stripper plate. The inside of this stripper plate should not have a sharp edge which might stop the sliding blank.

Die Design for Making Simple V-Bends

The bending die shown in Fig. 10 is intended for simple V-bends. In operation, the stock should be fed to the die by a gravity chute, the stock sliding between guides and coming to position against the stop-pins. When the ram descends and bends the stock, the ends of the bent piece are no longer in contact with the stop-pins. Since the die is in an inclinable press, the bent piece will slide out of the die. In some cases, it is necessary to have a simple spring-operated disappearing pin or pressure pad in the bottom of the vee to dislodge the bent piece if it sticks in the die. The main point is to so design the die that the bent piece will not be in contact with the stop-pins, but will be free to slide out of the die. In making U-bends, it is, of course, necessary to use a pressure pad in the lower die member.

In most of the designs shown, the stock is fed to the die set by gravity, and the pieces are automatically ejected. Since the danger element has thus been entirely eliminated, the stock can be entered in the die set during the up stroke and the start of the down stroke of the ram. Theoretically, this eliminates all lost time. In many cases, it will be found that the press will be too fast to be run wide open—that is, to step on the foot-pedal and keep it down. Though the operator may be able to keep up with a wide open press for short spurts, a pace will be set which, in the majority of cases, he cannot keep up over any appreciable period of time.

If the ram is stopped every cycle, the starting and stopping time is a considerable factor. The fatigue element in this type of operation is indirectly comparable to stop and go driving in traffic. Should the speed of the press be slowed down, so that the operator can reasonably load the press during the up stroke and the start of the down stroke of the ram, the machine will set a dead even pace which relieves the operator of all synchronizing effort. When the work is not too large, the operator can have a stock of blanks in front of him and simply keep flipping the blanks into the press. It should be noted that, in order to operate the foot-pedal every stroke, the operator would have to stand on one foot, which would greatly increase the fatigue.

The slowing down of the press, of course, reduces the momentum of the flywheel and thus decreases the blanking capacity of the press. This scheme is not recommended for all types of work, but merely suggested as a possibility for certain types of repetitive punch-press operations. This method of increasing efficiency has been tried and found to be practical.

Fixture for Grinding Eccentric

By J. R. WHITTLES, Holden, Mass.

The grinding fixture shown is designed to hold the work indicated by dot-and-dash lines while grinding an eccentric surface in a cylindrical grinding machine. The work has an arm with a hole in its outer end used for locating purposes. The eccentric is located by placing the hole in the arm over plug *H* in the fixture.

The fixture is made with a circular tongue or pilot *P* which fits a groove in the headstock faceplate and thus locates the fixture with the center line of the eccentric in alignment with the headstock spindle. Hole *F* in the flanged part of the fixture is located off center 1/8 inch.

The work is placed through hole *F*, which forms a bearing, and over plug *H*. Jack-screw *E* is pressed against the flanged part of the work to hold it in place while grinding. Body *A* is made of cast iron, the slots at *I* in the circular flange being used to bolt the fixture to the headstock faceplate.

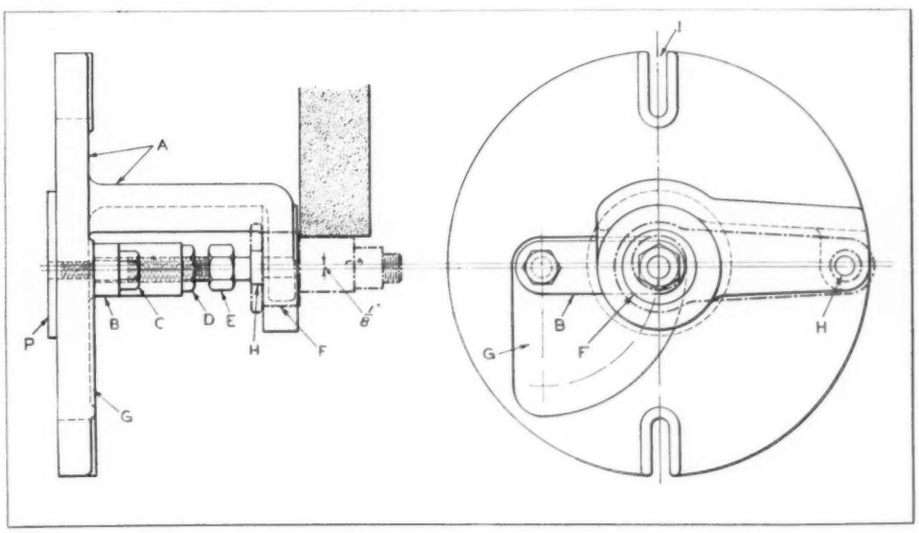
One side of the top or hood is left open to permit inserting the work and to allow jack-screw *E* to be swung into or out of the clamping position. Holder *B* for the jack-screw is made of steel and has a hole in it for shoulder screw *C*, which forms a pivot. Jack-screw *E* is screwed into the holder and locked with check-nut *D*. Holder *B* slides on pad *G* while being swung outward to permit loading.

Experimental Press and Die

By VINCENT WAITKUS, Baltimore, Md.

Considerable experimental work is often necessary in working out the details of dies for new products or for operations on new materials. The press shown in Fig. 1 was designed to facilitate experimental work of this kind. It is operated by a handwheel attached to the heavy screw used to exert the pressure required for actuating experimental dies.

A hand-operated press of this design is especially useful in developing dies for performing operations on elastic materials, such as the small molded disk indicated at *A* in view *W*, Fig. 2. The behavior of materials such as that used for disk *A*, when subjected to forming or other die operations, should be determined before a permanent production die is constructed. The experimental press provides a



Fixture Designed for Grinding an Eccentric Bearing on Work Shown by Dot-and-dash Lines

means for conveniently and economically making the necessary tests under conditions simulating those encountered in actual production work.

The experimental die shown in the press in Figs. 1 and 2 was developed to perform a combination forming and assembling operation on a product consisting of the blank *B* and disk *A*, Fig. 2. The purpose of the die is to form blank *B* to the cup shape indicated in view *Y*, and to simultaneously press disk *A* into the formed member on the downward stroke of the punch, disk *A* being placed in slot *a*, Fig. 1, before starting the downward movement of the punch. The successive operations performed by this die are indicated in their proper sequence by views *W*, *X* and *Y*, Fig. 2. It will be seen by referring to these views how the forming and assembling operation is completed in a single downward stroke of the punch member.

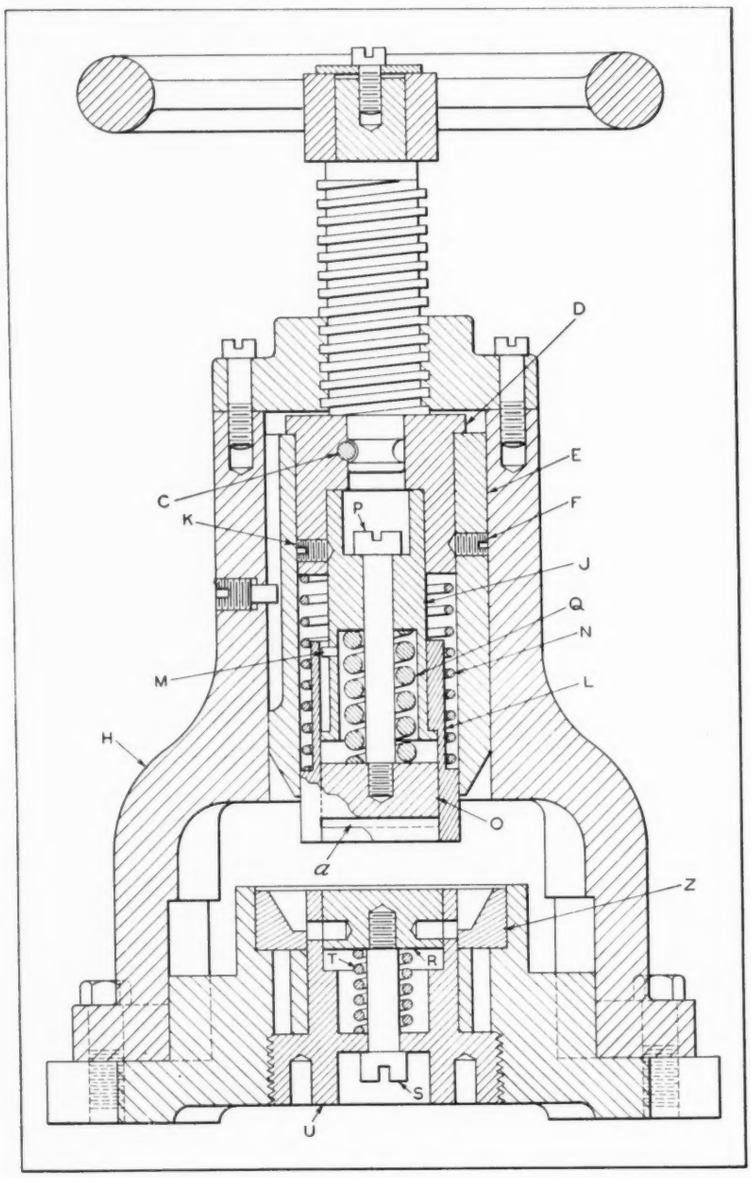


Fig. 1. Hand-operated Screw Press and Die Used to Obtain Data for Designing Production Dies

Frame *H* of the press is fastened to a bolster plate, as shown in Fig. 1. A cap bolted to frame *H* is threaded to receive the power screw which is fitted with a handwheel. The lower end of the press screw is turned down and machined with a groove for a retaining pin *C*. This arrangement provides a positive connection for withdrawing the punch, yet permits free rotation of the power screw.

The punch assembly consists of main holder *D*, to which sleeve *E* is fastened by a screw *F*. The sleeve is provided with a keyway to accommodate a pin key threaded to fit a tapped hole in frame *H*. This pin keeps the sleeve from rotating in frame *H* when the hanwheel is turned. An auxiliary sleeve *J* is fastened to holder *D* by a screw *K*. Retainer sleeve *L* is a sliding fit on auxiliary sleeve *J*. Pin *M*, fitted into a keyway cut in the retainer sleeve, prevents the sleeve from rotating. A shoulder on auxiliary sleeve *J* keeps retainer sleeve *L* from sliding off under the action of spring *N*. Ejector *O* is fastened to bolt *P*, which is free to move in a hole in sleeve *J*. The head on bolt *P* limits the movement of the ejector under the action of spring *Q*.

The die member consists of stationary form *U*, which is screwed into the bolster plate. This member is designed for easy removal. An ejector *R* is fastened to bolt *S* which limits the movement of the ejector under the action of spring *T*. Ring *Z* is forced into place in the bolster plate so that the upper face is slightly below the face of the die, an amount equal to the thickness of the material being formed.

The view at *W*, Fig. 2, shows the various members of the die in their relative positions with a blank *B* on form *U* and ring *Z*. Member *Z*, being set lower than the face of the bolster plate, serves to position blank *B* in the die. Disk *A*, which has previously been placed under ejector *O*, Fig. 1, by passing it through a slot *a* in sleeve *L* is brought into contact with blank *B*. The punch assembly continues to move down, performing the next step in the operation as indicated in view *X*, Fig. 2. Spring *T* is compressed slightly, but spring *Q*, which is of heavy construction, is not yet compressed. Compression of spring *T* permits ejector *O* to drive disk *A* and blank *B* into the recess formed by the receding ejector *R*, forming the blank to a cup shape around the disk.

The positions of the punch and die members at the completion of the downward stroke of the punch member are shown at *Y*. The final operation in assembling the two members of the product is completed when the punch member has reached the end of its downward move-

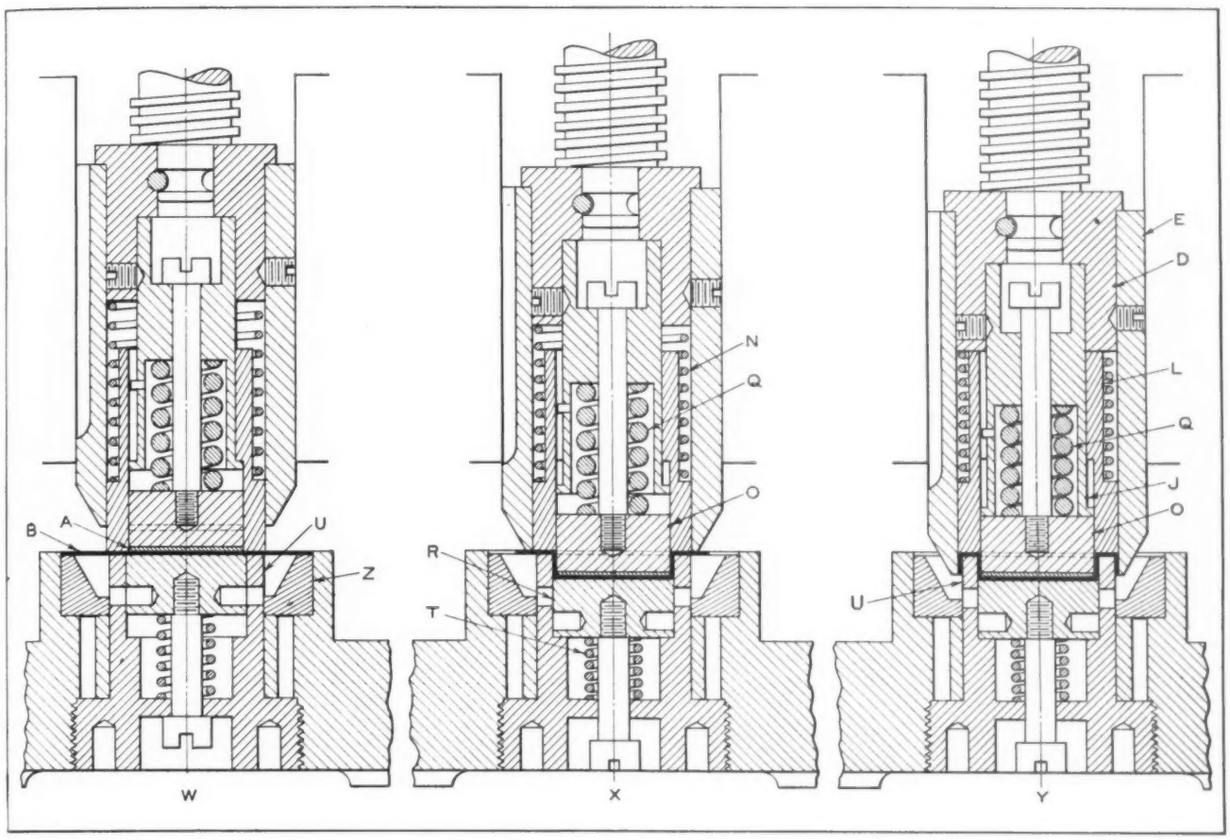


Fig. 2. Views Showing Operation of Experimental Die Used in Forming Blank B and Simultaneously Assembling Disk A in the Shell Formed from Blank B

ment, as shown at *Y*. The punch assembly, in moving downward, compresses the heavy spring *Q*, finally reaching the limit of its downward movement, so that member *D* rests on sleeve *L* and auxiliary sleeve *J* rests on ejector *O*. In this operation, the blank *B*, being retained on form *U* by sleeve *L*, is shaped over the edge of the form by sleeve *E*. As the punch assembly withdraws from the die, ejectors *O* and *R*, under the action of their respective springs, serve to free the completed product from the die.

Fixture Designed for Use in Sawing Off Connecting-Rod Caps

By EDWARD L. PETERSON, Chicago, Ill.

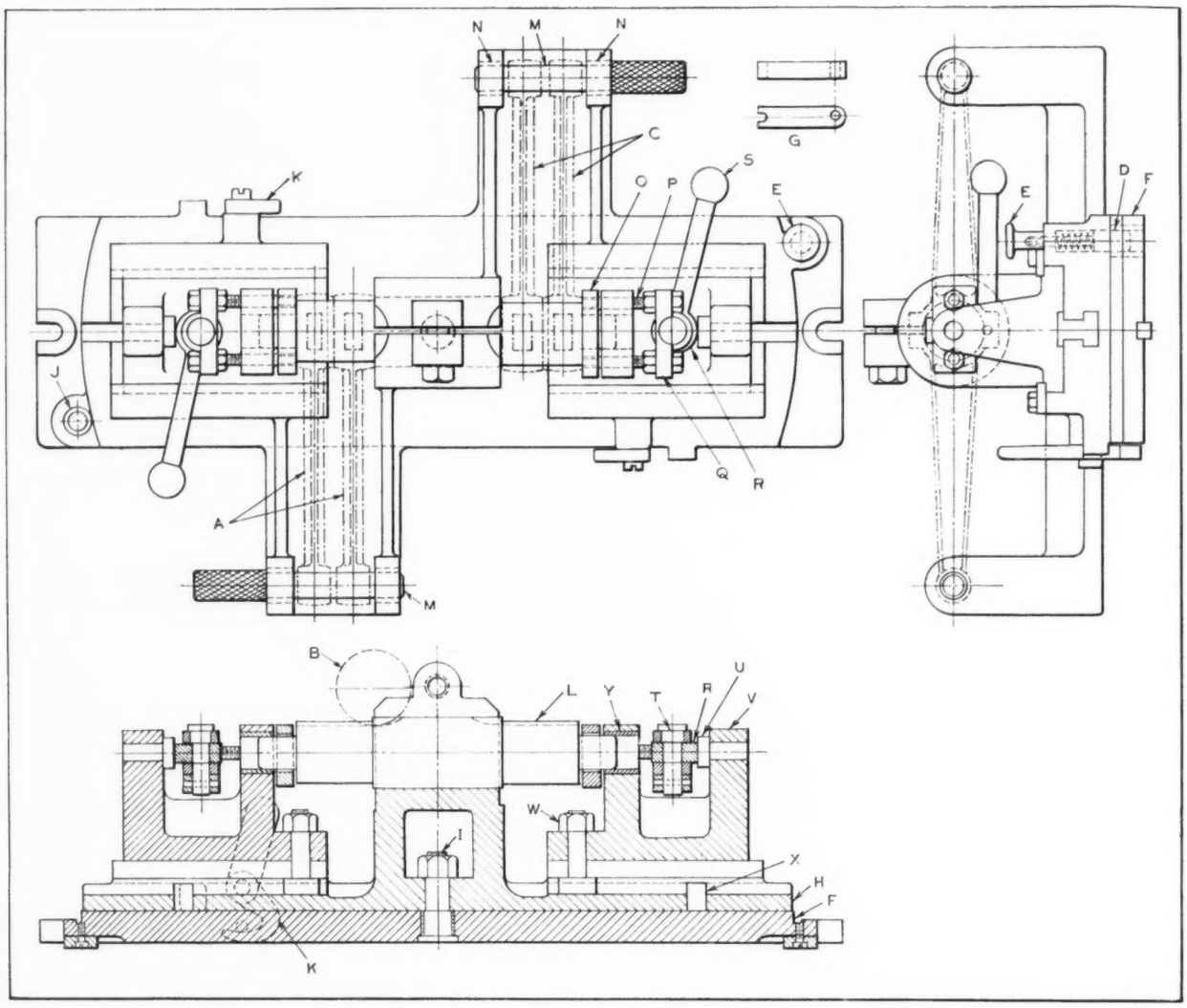
The illustration (see next page) shows an indexing type fixture having two work-holding stations, one of which is in the working position while the other is in the loading or work-changing position. The fixture is designed for holding connecting-rods while taking saw cuts that cut off or separate the bearing caps from the large ends of the rods.

Two rods *A* are located in the working position, in which saw *B* cuts through one side of the large end of each connecting-rod. While this cut is being taken, two rods *C* are clamped in the fixture. When the cut is completed on rods *A* and the machine table has been fed back, so that the cutter clears the work, index-pin *D* is raised by means of the button head *E* and held so that it clears base *F* by placing spacer *G* under the head of button *E*.

The fixture, with its sub-base *H*, is then indexed 180 degrees about pivot stud *I*. Spacer *G* is then removed so that index-pin *D* will enter the hole in bushing *J*, thus locating the fixture in position for taking a saw cut through rods *C* which are now in the position previously occupied by rods *A*. Sub-base *H* is then locked to base *F* by hook-lever *K*. While the cut is being taken on the second pair of connecting-rods, the first pair is removed from the locating arbor and replaced with the opposite or uncut sides of the large bearings uppermost.

The next indexing movement of the fixture brings these rods into position for the second cut, which severs the bearing caps from their respective connecting-rods. When these rods are again indexed to the work-changing position, they are removed and replaced by two new rods. This cycle of operations is then repeated.

The illustration is diagrammatic, in that only two pieces of work are shown in each position and minor details have been eliminated to permit the operating principles to be presented more clearly. In actual practice, the fixture should be built to hold a larger number of connecting-rods, in order to reduce the indexing and loading time per piece.



Fixture with Two Work-holding Stations that are Alternately Indexed to the Working Position for a Sawing Operation

The bores in the large ends of the connecting-rods are a slip fit on mandrel *L*. The connecting-rods are located in a horizontal position, as shown, by knurled-head mandrels *M*, which are a slip fit in the holes in the small ends of the connecting-rods, and bushings *N* fitted in the supporting brackets that are cast integral with sub-base *H*. Mandrel *L* is located parallel with the top surface of the machine table, and is clamped securely in a hole in a lug cast integral with the sub-base of the fixture.

The work is clamped on mandrel *L* against a shoulder by means of clamp *O*, actuated by rods *P* in bar *Q*, through the action of eccentric cam *R* operated by lever *S*. Cam *R* is inserted in a rectangular hole in bar *Q* and is free to rotate the amount required for clamping. Cam *R* is also keyed to pin *T*, which is a free fit in bar *Q*. Lever *S* is secured to pin *T* by a taper pin. When lever *S* is moved, with pin *T* as its pivot, cam *R* bears against button *U*, thus causing clamp *O* to hold the work securely against the shoulder on mandrel *L*.

In loading the fixture, nut *W* is loosened and slide *V* moved back until the T-bolt comes in contact with pin *X*. The eccentric cam should be turned to release the work before slide *V* is moved back and locked in the position shown. In this position, mandrel *L* is supported by the close-fitting bushing *Y*. Pivot pin *I*, located in the center of the fixture, is pressed into sub-base *H* and locked in place by a nut. This pin is a close running fit in a bushing pressed into base *F*.

Roller Type Tool for Shell Trimming Machine

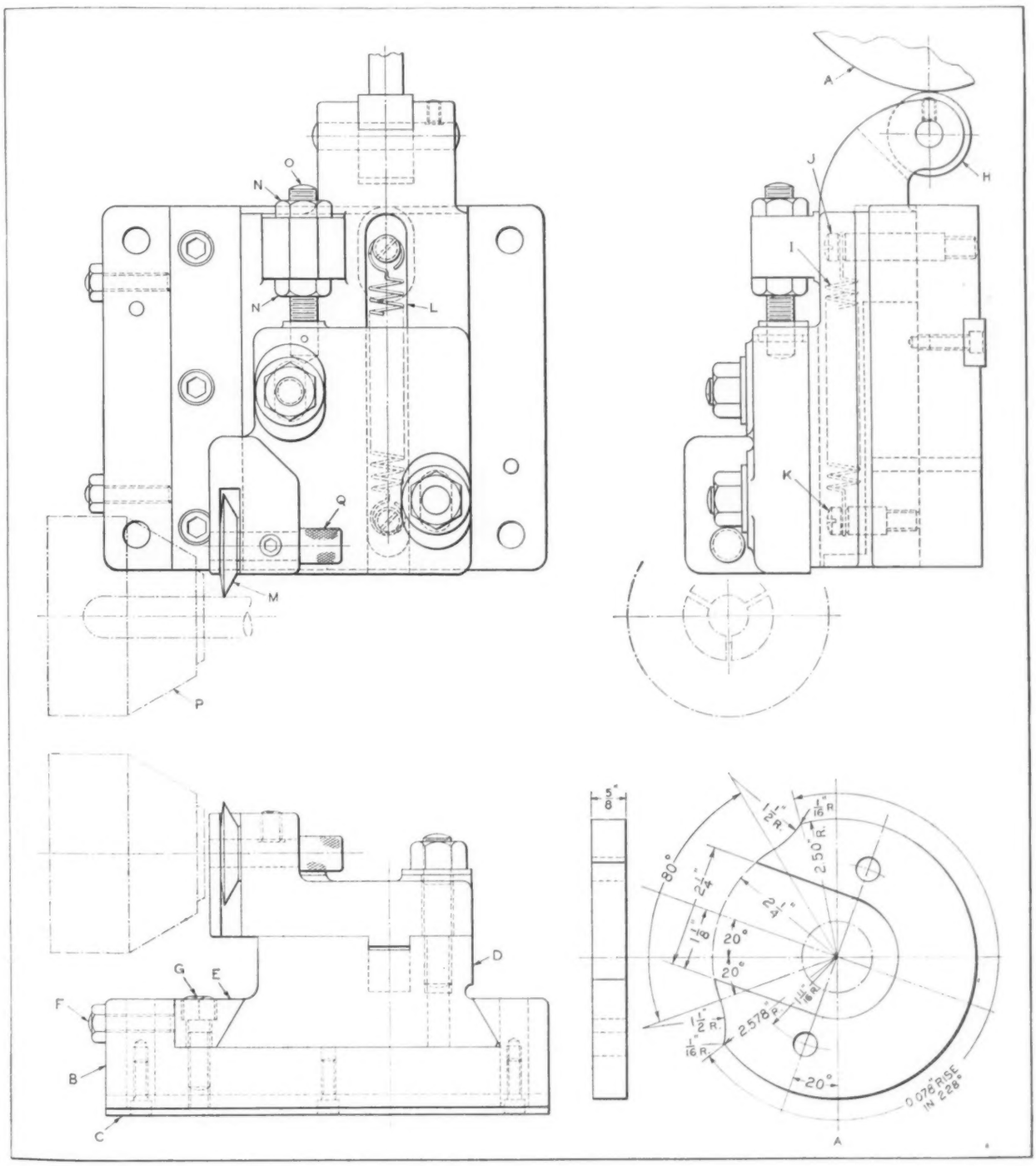
By JOHN A. HONEGGER, Bloomfield, N. J.

Probably few operators of shell trimming machines realize that the scalloped edges of cylindrical drawn shells can be trimmed more efficiently with a rotary or roller cutter than with the cutting-off tool bits generally employed. If a shell is not gripped tight enough in the collet chuck and the

tool bit is fed forward at a rapid rate by the feed-cam, the point of the tool is likely to be jammed into the shell, causing it to start rotating suddenly, with the result that the tool bit is broken. The machine must then be shut down until a new bit is placed in the tool-slide. Such occurrences upset the production schedule.

To eliminate as far as possible idle machine time resulting from trouble of this kind on several Waterbury-Farrel shell trimmers, the writer substituted a roller type cutting-off tool for the regulation cut-off slide. After this change was made, the machines were idle only once during the day, whereas they had previously averaged five or six idle periods a day.

The roller type tool-slide designed for this work is shown in the accompanying illustration. A cam such as shown at *A* is placed on the feed camshaft of the machine, which rotates in a clockwise direction at the rate of 50 R.P.M. Directly in front of this camshaft and in contact with cam *A* is the movable tool-slide, which carries the tool forward and backward for the trimming operation. The lower member or saddle *B* of this slide is station-



Roller Type Tool Designed for Shell Trimming Machine

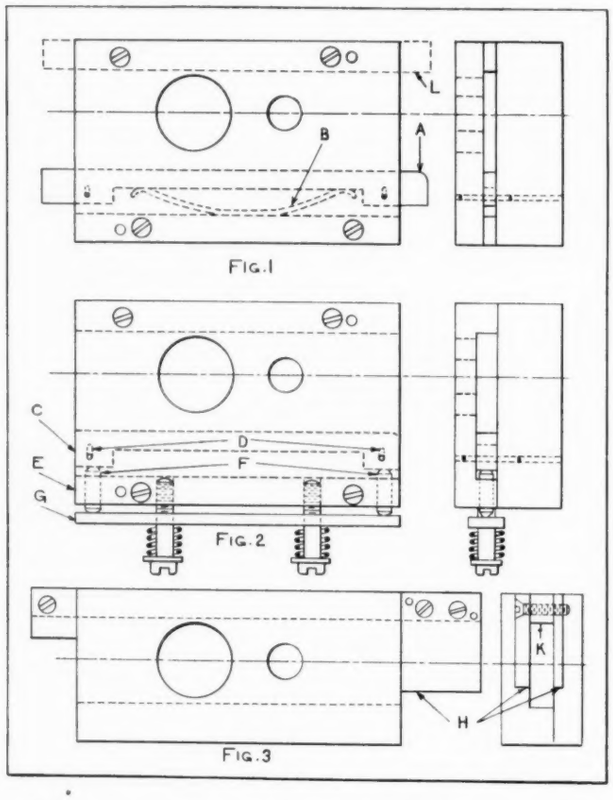
ary, and is located on the machine by means of the key *C*. Longitudinal movement of saddle *B* is prevented by fastening it to the machine with dowels and screws. Any play or looseness in the dovetailed slide *D* can be taken up by the gib *E* through adjustment of the screws *F*, vertical clamping of the gib being obtained by screws *G*. The holes in the gib for the clamping screws are drilled over-size to allow for lateral adjustment of the gib.

A slotted lug at the rear of slide *D* is fitted with a roller *H* which is held in contact with the cam *A* by a powerful spring *I*, one end of which is fastened to a pin *J* in saddle *B*. The other end of the spring is fastened to the pin *K* in slide *D*. It will be noted that the coil spring *I* is located in a slot *L* cored in slide *D*. The holder for the roller cutter *M* is bolted to slide *D*, a locating key and slot being provided to insure accurate alignment.

Adjustment of the roller tool holder is obtained by means of the two adjusting nuts *N* which move the stud *O* in and out of a lug cast on the slide *D*. With this arrangement, the length of the stroke imparted to slide *D* by cam *A* can be constant, while the tool-holder can be adjusted to change the distance from the center line of the chuck collet *P* to the cutting edge of the roller cutter *M*. The roller cutter turns on a hardened and ground pin *Q*, which is held in place by a headless set-screw. The collet *P* is shown in dotted lines to indicate the relative positions of the roller slide and the spindle.

The roller cutting-off blade or tool is made from a good grade of oil-hardening tool steel, its shape being similar to that of a regulation pipe cutter roller. There is, however, on the side facing the spindle, a slight wedgelike taper on the roller. This taper tends to roll any burr produced toward the inside of the shell rather than to raise the burr on the outside, where it might interfere with succeeding operations.

The cutting-off roller can be used for cutting off from 100,000 to 150,000 shells before regrinding is necessary. The roller can be ground three or four times before it is discarded. The material used for the shells trimmed by this machine is S A E 1010 cold-rolled half-hard strip steel.



Figs. 1 and 2. Dies Equipped with Spring Tension Guides
Fig. 3. Die with Extended Guides for Locating Strip Stock

Adjustable Tension Guides for Blanking Dies

By DONALD A. BAKER, West Hartford, Conn.

A common form of tension guide for blanking and piercing dies, in which the guide strip *A* is held against the stock by the action of spring *B*, is shown in Fig. 1. There are times when this type of spring arrangement works very satisfactorily, but it has the drawback of not providing any means of adjustment. This is an important feature, since the tension required varies according to the weight of the stock, its flexibility, and other factors that can only be determined by actually running the stock through the dies.

To overcome this objection, the writer recently redesigned the guides on several dies that had been giving trouble. The improved arrangement is shown in Fig. 2. The guide strip *C* is held in place by two pins in the slots *D* driven into the stripper plate *E*. The two pins *F* pass through holes drilled in the edge of the stripper plate *E*. One end of these pins rests against guide strip *C* and the other end against a cold-rolled steel strip *G*, which is held in place by two screws and springs, as shown. With this arrangement, it is a simple matter to adjust the screws for any desired tension, with the dies set up in the press and under actual working conditions.

Another common cause of trouble is due to the fact that the guide strips often extend beyond the edges of the die and stripper plate, as indicated by the dotted lines at *L*, Fig. 1. These strips will guide the stock only when it is carefully held in a horizontal position. This trouble can be overcome by adding two pieces of sheet metal *H* to the top and bottom of the rear guide strip *K*, at both ends, as shown in Fig. 3. This will hold the stock in the proper alignment.

* * *

The interest in the standardization and measurement of surface finish is constantly growing, and there is an increasing demand for simple devices for accurately indicating quality of finish.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Quick-Acting Jig Clamp

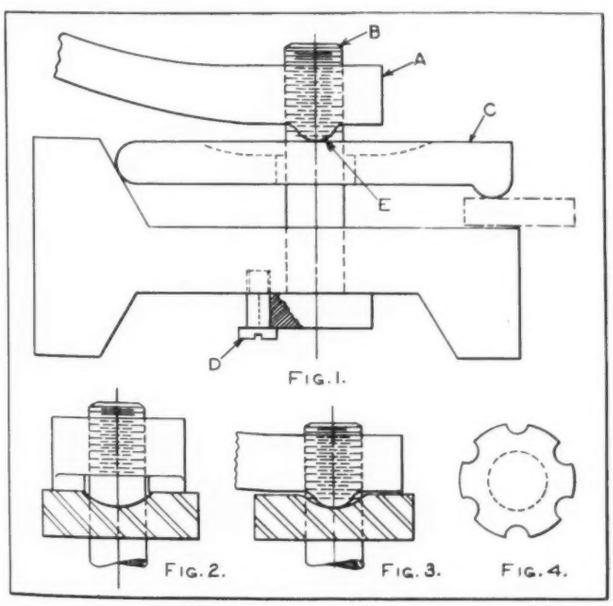
The accompanying illustration shows a simple quick-acting jig clamp. It will be noted from Fig. 1 that the handle *A* is threaded to fit screw *B*, and has a cam lobe *E* on it which engages strap *C*. As handle *A* is turned, cam *E* quickly applies pressure to strap *C*. A movement of approximately 90 degrees of handle *A* produces the clamping action on the work. This allows for a variation in the thickness of the piece to be clamped equivalent to one-fourth the lead of the screw thread advancement. For example, with a 5/8-11 screw, a tolerance of plus or minus 0.011 inch would be allowed in the work.

A groove is cut in the upper surface of strap *C*, and when the strap is loose, the cam rests in this groove, as shown in Fig. 3. About 30 degrees movement of handle *A* is required to cause cam *E* to ride on top of the strap, as shown in Fig. 2.

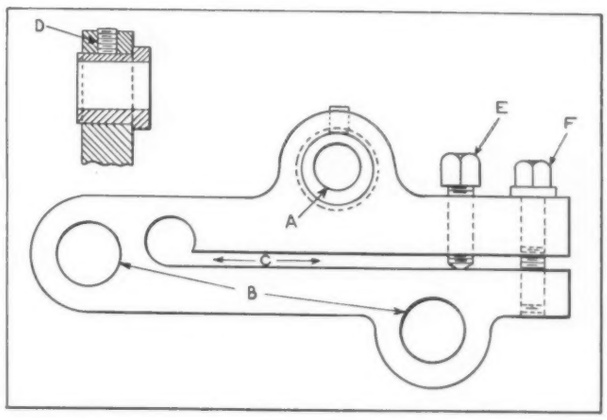
The head of screw *B* has six grooves in it, as shown in Fig. 4, which are engaged by set-screw *D* to keep screw *B* from turning. To adjust the lever or tighten the strap when parts wear, screw *B* is turned to a new position, and locked in place by set-screw *D*. Set-screw *D* also serves to keep screw *B* from dropping out of the jig.

It is advisable to make a positive stop for handle *A*, so that the cam will not fall into the groove by a 180-degree turn and loosen the strap.

Paxton, Mass. VICTOR ROSENLUND



Clamp with Cam Action for Quick Operation



Shaft Aligning Device Having Both Vertical and Horizontal Adjustment

Adjustable Shaft Aligning Device

The accompanying illustration shows a shaft locating or centering device which permits a short shaft supported in the bushing *A* to be moved in any direction for alignment purposes. As shown by the sectional view, the hole bored in the bushing is off center; thus when the bushing is revolved, the shaft is moved to the left or to the right. The screw *D* serves to lock the bushing in place. The device is mounted on two rods that pass through the holes *B*. To permit vertical adjustment of the shaft, the unit is split, as shown at *C*. The vertical movement of the shaft is effected by turning the screw *E*, and the screw *F* is used to hold the shaft securely in position after the required adjustment has been made. H. M.

Improvised Steadyrest Made from Hard Wood Block

Recently the writer had occasion to drill and tap both ends of an armature shaft of a 1/2-horsepower motor in a lathe having no steadyrest. The job was accomplished satisfactorily by using a steadyrest made from a piece of hard wood. The piece of wood was held in the place of the tool-holder and clamped in line with the lathe spindle.

A 3/4-inch hole drilled and reamed in the wood supported one end of the armature, while the opposite end was gripped by a draw-in chuck. The tailstock was used in the regular way for drilling and tapping.

North East, Pa. J. W. HERRIMAN

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

A. D. C.—In a case where the highest possible physical properties are desired in a forging or in a hot-rolled bar, please advise the best procedure in heat-treatment. Should the steel be normalized and annealed? Will the use of both of these processes give better results than only one, prior to quenching? Does quenching from the drawing temperature improve the impact properties of nickel-chromium and straight-nickel steels?

Answered by Editor, "Nickel Steel Topics"
International Nickel Co., Inc., New York City

Where the highest possible physical properties are desired, alloy steels should always be normalized before quenching. Annealing, however, should not be necessary, except where it may be required to make the material machinable. In the case of large forgings, it is often advisable to normalize, quench, and draw the temper previous to machining, and then follow with a second quenching and tempering operation on the finished part.

Quenching from the drawing temperature does not improve the impact properties of steels, except in the case of those that show temper brittleness. Straight-nickel steels are not subject to this, and, therefore, it is never necessary to quench them before they are drawn. Some nickel-chromium steels are subject to temper brittleness if the alloy content is quite high. Even in such cases, a simple air cool is generally rapid enough to avoid trouble, unless the section is so heavy that the cooling rate is materially slowed down; then a quenching operation is advisable.

Which Railroad is Responsible for Damage to Shipment?

A. R.—When machinery is shipped over more than one railway, how is it determined which road is liable if the machinery is lost or damaged during transportation?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

The law is well settled that a common carrier, such as a railway or trucking company, which by its receipt and bill of lading agrees to transport goods to a destination, is liable as the initial carrier for goods lost in transit by a connecting carrier. This is true even when the connecting carrier is suggested by the shipper, since, by virtue of the receipt and bill of lading, the connecting carrier becomes an agent of the initial carrier.

For example, in Sunshine v. Chambers Truck Co. [107 S.W. (2d) 515], it was disclosed that an initial motor truck carrier issued to a consignor a bill of lading showing the receipt of the machinery, and its weight, and that freight was prepaid by the shipper. It was signed by the initial trucking company, through its agent.

The agent of the shipper stated to the agent of the initial trucking company that he had a friend with a connecting trucking line, and requested that the machinery be delivered to this designated trucking company. The machinery failed to reach the destination, and the question arose whether, under these circumstances, the initial trucking company was liable for the value of the goods. In holding the initial company liable, the Court said:

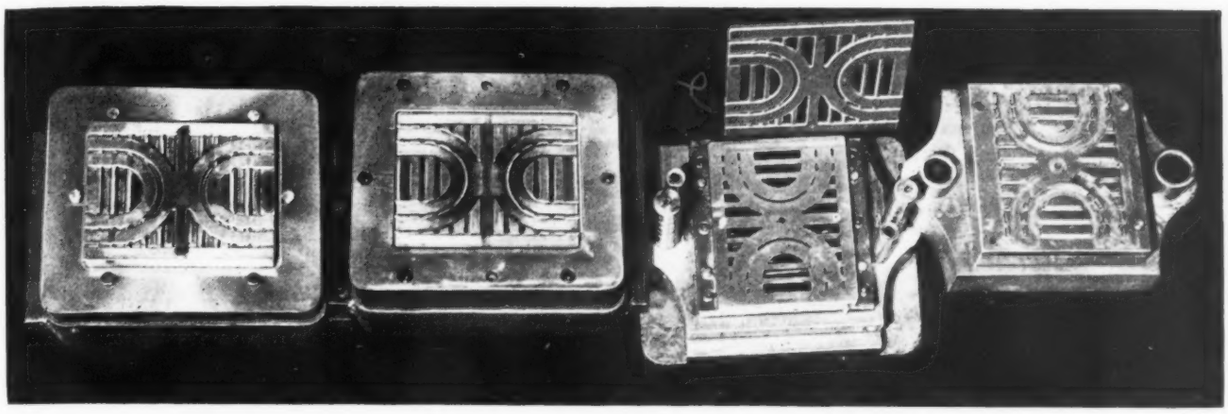
"This rule of liability is upon the idea that each connecting carrier is the agent or servant of the initial or contracting carrier. . . . We are further of the opinion that the defendant [trucking company] cannot escape liability because the connecting carrier was suggested by the shipper. . . . The shipper suggested and preferred this particular connecting carrier, but the defendant [trucking company] assented to the request, and by its receipt and bill of lading undertook to transport to destination. The connecting carrier was therefore the agent of defendant."

Obviously, if the testimony proves which connecting carrier is responsible for loss of, or damage to, shipped goods, the initial carrier may recover from this connecting carrier the amount that it paid out to the shipper.

* * *

During 1939, the General Electric Co. paid out $2,567,042 in pensions to retired employes. At the end of the year, there were 3410 men and women on the pension rolls. Their average age was 69.3 years; they had an average continuous service with the company of 29.3 years. The annual pensions averaged $756. At the end of 1939, the amount set aside by the General Electric Co. for its pension trust amounted to over $45,000,000.

Die Steel with High Wear Resistance and Minimum Distortion



Solid Radiator Grille Dies that Showed Little Distortion after Heat-treating

A DIE steel known as "Sparta" has been developed through the collaboration of the Universal-Cyclops Steel Corporation, Bridgeville, Pa., and the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., to meet the need for a steel that would combine the properties of high wear resistance and minimum distortion with relatively low cost. This steel is a modification of a 1 per cent carbon, 5 per cent chromium, air-hardening steel, made by the addition of 0.20 per cent vanadium to insure a wide heat-treating range and to provide protection against excessive grain growth, and 1 per cent molybdenum to induce high hardness and retention of hardness after drawing.

The effect of molybdenum on the hardness of 1 per cent carbon, 5 per cent chromium steel is shown by comparing Sparta steel (designated *C*) with a steel containing no molybdenum (*A*) and one containing a low molybdenum content (*B*). These three steels have the following compositions:

	A Per Cent	B Per Cent	C Per Cent
Carbon	1.03	1.00	0.97
Chromium	4.89	4.94	5.05
Vanadium	...	0.20	0.18
Molybdenum	...	0.48	1.07

After air-hardening, the hardness ranges of these steels were as shown in Table 1.

Table 1. Comparative Hardness of Three Types of Steel after Air-Hardening

Hardening Temperature, Degrees F.	Rockwell C Hardness		
	A	B	C
1700	39	46	64.5
1750	49	51	65.0
1800	54	64	65.0
1850	54	64	63.0

After drawing, the hardness range of the three steels at different drawing temperatures was found to be as shown in Table 2.

Table 2. Comparative Hardness of Three Types of Steel after Drawing

Drawing Temperature, Degrees F.	Rockwell C Hardness		
	A	B	C
As quenched	54	64	65
300	50	62	62
400	50	60	60
500	50	60	60
900	49	56	58
950	49	54	59
1000	..	..	58

With Sparta steel, full air-hardening can be obtained at the comparatively low temperature of 1700 degrees F. in small sections, say up to 1 inch thick, while higher temperatures—up to 1800 degrees F.—are required for larger sections. It will be seen from Table 2 that this steel retains its hardness to a remarkable degree at low drawing temperatures.

In the accompanying illustration are shown solid radiator grille dies which gave evidence of excellent resistance to distortion in heat-treatment. These dies were pack-hardened and air-quenched from 1800 degrees F., and afterward drawn at 400 degrees F., for three hours. The final hardness was 61 Rockwell C. Before hardening, the dimensions of the embossing die were 8.545 by 10.607 inches, and those of the perforating die, 8.880 by 10.548 inches. After hardening, the dimensions of the former were 8.547 by 10.609 inches, and those of the latter, 8.886 by 10.553 inches. The maximum change in any direction is very small, considering the size and nature of the dies.

The first costs in using this material are moderate, and the machining costs are said to be very reasonable. In some cases, it has been found possible to eliminate grinding after hardening, because the dies hold so closely to their original dimensions after heat-treating. Owing to its excellent performance characteristics, this die steel has been found useful in other fields, including the manufacture of cams, clutch parts, ways on lathes and grinders, wearing strips, and gages.

Metal Trades Convention Discusses Employer-Employe Relations

THE keynote of the forty-second annual convention of the National Metal Trades Association, held at the Biltmore Hotel, New York City, May 21 and 22, was sounded by William Carson, president of the Sunbeam Electric Mfg. Co., Evansville, Ind., in his address "Mutual Understanding—The Key to Sound Employer-Employe Relations."

This address, opening the Tuesday afternoon session, May 21, was followed by discussions of important industrial relations subjects led by a group of six of the leaders in the metal trades. Questions had been prepared in advance to which these men had been asked to respond. These questions covered the entire field of industrial relations, including job and employe rating, foremen training, apprenticeship training, and similar subjects. In addition, the members of the group were asked to review briefly their own company's labor policy and to explain why they believed that it had been successful in promoting sound industrial relations. After the six members of the selected group had made their presentation, the session was devoted to a general discussion of the topics under consideration, and an opportunity was given to ask the speakers questions.

The opening session of the convention was devoted to the reports of the officers, the principal report being that of the president, Nelson W. Pickering, president of the Farrel-Birmingham Co., Ansonia, Conn. Following the reports, was an address by J. Fulton Lewis, Jr., on "Events in Washington." This talk was followed by a series of questions by the members, the answers to which brought out many interesting details relating to current governmental policies. At the annual banquet held on the evening of the first day of the convention, the chief address was made by the Honorable Raymond E. Baldwin, Governor of Connecticut.

On the second day of the convention, Carl Taylor of Milwaukee, Wis., spoke on "What Makes America a Great Country." A. S. Redway, of the Farrel-Birmingham Co., discussed the subject of "Putting Job Rating to Work." The international situation was presented by J. Anton De Hass, of the Graduate School of Business Administration, Harvard University. H. M. Hubbard, of Harris-Seybold-Potter Co., Cleveland, Ohio, gave a stimulating address on "What the Engineer Needs to Know About Management," while Phil Hanna, editor of the *Chicago Journal of Commerce*, dealt with the subject "Whither Business?" in a highly interesting and instructive manner.

A stirring address entitled "Forward in Peace or Backward in War" was delivered by J. R. Murphy, who was captain of a machine gun company in the World War, and National Commander of the American Legion in 1936. Mr. Murphy painted a vivid picture of what will happen to this country and to the world if Germany wins the war.

N. W. Pickering, Past-president of the National Metal Trades Association

A. H. Timmerman, Newly Elected President of the Metal Trades Association

The officers elected for the coming year are as follows: President, A. H. Timmerman, vice-president of the Wagner Electric Corporation, St. Louis, Mo.; first vice-president, Roe S. Clark, of the Package Machinery Co., Springfield, Mass.; second vice-president and treasurer, Harry H. Kerr, president of the Boston Gear Works, North Quincy, Mass.

Gear Manufacturers Meet in the South

THE twenty-fourth annual meeting of the American Gear Manufacturers Association was held May 20 to 22 at the Grove Park Inn, Asheville, N. C. As usual, the program included a number of comprehensive technical papers.

The meeting was opened by the president, Charles F. Goedke, who welcomed the members and guests and briefly reviewed present conditions in the gear industry. Following the reports of the various officers and committees, eight papers of an important character were presented.

A paper entitled "Developments in the Production of Fine-Pitch Gears" was read by D. T. Hamilton, of the Fellows Gear Shaper Co., Springfield, Vt. In this paper, accompanied by a number of lantern slides, the author described in detail the procedure followed in cutting fine-pitch gears.

Everett Chapman, of Lukenweld, Inc., Coatesville, Pa., in discussing "Recent Developments in Welded Gears and Gear-Cases," called attention to the advantages and possibilities of the use of welded construction for purposes of this kind. A most exhaustive and highly technical paper on "Roller and Gear Pitting Tests" was presented by Dr. Stewart Way, of the Westinghouse Electric & Mfg. Co. The general object of these tests was twofold—to measure the resistance of different materials to pitting under various conditions, and to arrive at an understanding of the reasons for failure of the surfaces of rollers and gear teeth.

In a paper, "My Experience with Gear Tooth Forms," A. A. Ross, of the General Electric Co., presented a number of examples, together with information of considerable value in dealing with design problems. The paper "Tooth Bearings in Bevel Gears," by A. H. Candee, of the Gleason Works, presented a complete analysis of the conditions existing in different types of bevel gears—straight, spiral, hypoid and zerol. Conditions existing in Diesel and gas engine drives were referred to in a paper by Austin Kuhns, of the Farrel-Birmingham Co., entitled "Diesel and Gas Engine Load Characteristics." This paper dealt specifically with propulsion gearing.

Subjects pertaining more specifically to the business side of the industry were discussed by E. Payson Blanchard, of the Bullard Co. in his address "Boring Mills in a Gear Shop," and by W. L. Schneider, of the Falk Corporation, who presented a carefully prepared survey on "How is Business?". At the annual dinner, held on the evening of May 21, George F. Nordenholt, editor of *Product Engineering*, spoke on "New Products—A Threat or a Promise?".

U. Seth Eberhardt, vice-president and general manager of the Newark Gear Cutting Machine Co., Newark, N. J., was elected president of the Association, and W. P. Schmitter, chief engineer of the Falk Corporation, Milwaukee, Wis., was elected vice-president.

Meeting of Associated Machine Tool Dealers

THE spring convention of the Associated Machine Tool Dealers of America was held May 13 and 14 at the Hotel Claridge, Atlantic City, N. J. About one hundred members and guests were present.

At the first session, John Sauer, Jr., president of the Association, and secretary-treasurer of the Peninsular Machinery Co., Detroit, Mich., opened the meeting, after which several papers were read. George A. Fernley, advisory secretary, spoke on "Taxes." H. W. Young, production manager of the Hamilton Watch Co., Lancaster, Pa., presented a paper on the production of interchangeable precision parts, as applied to the making of watches. Colonel H. L. Campbell, of the Frankford Arsenal, Philadelphia, Pa., read a paper on "Artillery Shell Production," illustrated with motion pictures and lantern slides, giving details of the methods used by the Ordnance Department in this important branch of munitions manufacture.

At the convention dinner, Burnham Finney, editor of the *American Machinist*, spoke on "After the War, What?". In this address he dealt with the industrial problems that are likely to arise at the end of the war. On the same occasion, Commander H. M. Scull, of the United States Navy, spoke on "Navy Procedure in Machine Tool Purchases," and Dr. Allen A. Stockdale, of the National Association of Manufacturers, spoke on "Free Enterprise in Free America."

At the session Tuesday forenoon, the following papers were read: "What to Sell when Factories are Loaded and Deliveries are Bad," by F. W. Schiefer, of the F. W. Schiefer Machinery Co., Rochester, N. Y.; "How the Machine Tool Market is Affected by the Airplane Industry Activity," by D. N. Macconel, of the Machinery Sales Co., Los Angeles, Calif.; "Special Ordnance Machine Tools," by Tell Berna, general manager of the National Machine Tool Builders' Association, Cleveland, Ohio; and "The Machine Tool Industry under Pressure," by John E. Lovely, president of the National Machine Tool Builders' Association. Wednesday, May 8, following the meeting, an inspection trip was arranged to the Frankford Arsenal.

Westinghouse Machine Tool Forum

THE Machine Tool Electrification Forum, organized by the Westinghouse Electric & Mfg. Co., was held at the Westinghouse plant at East Pittsburgh, Pa., May 6 to 8. A varied program covering many phases of the application of electrical equipment to machine tools, as well as general-industry problems, had been arranged. The meeting was opened by an address by Bernard Lester of the Westinghouse company, who briefly reviewed the history of the Machine Tool Electrification Forum, the first meeting of which was held in the spring of 1936. In the course of his address, Mr. Lester referred to some of the long-range trends that may be observed in the machine tool industry, also pointing to their significance:

1—The number of daily hours during which men, and consequently machines, work, is steadily becoming less; hence, the machine operator's time costs more. This means that efforts must be bent toward further increasing the operating efficiency of the machine, particularly in regard to a reduction in the time required for setting-up operations.

2—Originally it was thought that the man should adapt himself to the machine, but today we are confronted with the job of making the machine adaptable to the man. Machines must become still more convenient, quiet, and free from vibration.

3—The appearance of a machine will continue to become more and more of a factor, and will be given more consideration by machine buyers.

4—In common with all machinery, machine tools will be continually redesigned to turn out more work with greater accuracy and a higher degree of uniformity. Machine tools will be more completely equipped with all sorts of "tell-tale" devices, to show at a glance just what the machine is doing.

5—Adjustable and selected speed reductions or speed increases, whether accomplished electrically or mechanically, or both, will receive even more attention than in the past. The equipment will be simplified, made more convenient, reliable, and efficient, and the apparatus will take up less space.

Adjustable-Speed Alternating-Current Drives

An exhaustive paper on adjustable-speed alternating-current drives was read by W. I. Bendz, Boston district engineer of the company. This paper, illustrated by a large number of photographs and drawings, described several of the systems and the equipment used for adjustable-speed alternating-current drives.

In a paper entitled "Can You Use a Gear Motor?", S. B. Brittain, of the Westinghouse Gearing Division, briefly pointed out the advantages of gear motors, mentioning their particular advantage in driving special machine tools made up of standard heads and assemblies.

An interesting design trend was covered in a paper by J. C. Wilson, of the Thompson Grinder Co., Springfield, Ohio, entitled "Combination of Electrical and Hydraulic Operation of Automatic Broach Grinding Equipment." The author called attention to the recent trend toward surface and internal broaching on mass production jobs, which has created a demand for a fast and accurate method of producing and reconditioning broaches. To meet this demand, a machine tool of entirely different design and operating characteristics than the conventional type of tool- and cutter-grinder was required. The machine evolved to meet the new conditions was described.

Cooperation between Electrical Manufacturer and Machine Tool Builder

An address less technical in character, but no less interesting to machine tool designers, was that by C. B. Stainback, manager of the Westinghouse Industrial Sales Department, entitled "Responsibilities of the Electrical Manufacturer to the Machine Tool Industry." In opening his address, the author said that the subject might as well have been entitled "The Responsibilities of the Machine Tool Industry to the Electrical Manufacturer," or better yet, "The Joint Responsibility of One Great Industry to Another." It was along these lines that he presented to the assembled machine tool engineers a comprehensive review of what the two industries have accomplished, what is still to be done, and what teamwork can accomplish.

Robert S. Elberty, electrical engineer of the Landis Tool Co., Waynesboro, Pa., presented a comprehensive paper describing in considerable detail the electrical equipment for a special-purpose grinding machine—the Landis "Race-A-Way" grinder. In this paper, Mr. Elberty covered in detail the wheel drive, the pump drive, the work drive, work oscillation, and the various controls of the machine.

Starting his address with the statement that a motor driving its load through an "electrical shaft" opens up a new field for electricity in machine tools, C. W. Drake, manager of the Westinghouse General Mill and Resale Section, described the application to a large boring mill now being built, which will have its traverse mechanism driven from its main motors through what is known as a "Synchro-Tie" drive. The flexibility of this type of drive was stated to be exceptional. Features not obtainable with mechanical transmission were emphasized.

A detailed review of methods of training skilled workers for industry was given in a paper by C. D. Moore, supervisor of trades training of the Westinghouse company. This paper reviewed the dif-

ferent classes of training provided at the Westinghouse plant, including the four-year apprenticeships for machinists, toolmakers, diemakers, and patternmakers, as well as other trades necessary in the electrical industry. The two-year program of training provided for many occupations that require men who have had a certain amount of experience and training, but not necessarily a four-year course, was also described.

Typical wiring arrangements for basic control functions were dealt with in a paper by O. G. Rutemiller, Detroit district engineer of the company. The author called attention to the trend in the development of production machine tools toward "automatic cycling" machines. This trend is particularly noticeable in the automotive industry. Machines of this type depend almost entirely on electrical control for their operation. The paper described the different types of control suitable for various functions. Closely allied to Mr. Rutemiller's paper was that by D. K. Frost, electrical engineer of the Mattison Machine Works, Rockford, Ill., who spoke on "Applying Control Equipment to Machine Tools." In this paper, Mr. Frost outlined some of the important considerations in connection with control equipment.

Another paper of direct application to the machine tool industry was that by A. H. Platt, electrical engineer of the Bullard Co., Bridgeport, Conn., who spoke on installation and maintenance of electrically equipped machine tools. In this paper, Mr. Platt dealt with the preparation for the installation of such machines, listed the advance information needed, gave advice with regard to shipping and maintenance, and discussed the use of enclosed motors, the need for accessibility, and the requirements with reference to spare parts.

The meeting was attended by over one hundred engineers and designers in the machine tool industry, as well as by a large number of managing executives. Opportunity was also afforded the visiting engineers to inspect the Westinghouse plant.

Warner & Swasey Inaugurates Educational Program for Machine Operators

AN educational program designed to aid in the training of apprentices, as well as to help the experienced operators of the 55,000 turret lathes in use in this country, has been inaugurated by the Warner & Swasey Co., Cleveland, Ohio. For this purpose, the company has organized a turret lathe operators "Service Bureau," which is designed to help the machine tool using industries solve the production problems that the lack of skilled mechanics creates every time operations reach a high level.

While the object of the bureau is specifically to aid and increase the efficiency of turret lathe operators, the principles involved apply equally well in any field of machine tool operation. The service bureau will send lecturers into manufacturing plants all over the country; these men are equipped with sound slide films, charts, and models to show operators improved techniques for utilizing turret lathes and their tooling equipment. A 240-page text-book on the operation of turret lathes, published by the bureau, also gives the operators an opportunity to gain additional knowledge about their work through home study. The company also sends out a monthly publication known as *Blue Chips*, which affords an opportunity for the exchange of ideas and keeps operators posted on the latest developments in their field.

The importance of efforts of this kind is easily appreciated when one remembers the fact that whenever the metal-working industries reach a high level of operation, it is impossible for them to find enough skilled mechanics, although millions of men are recorded as unemployed.

The lecturers of the Warner & Swasey Service Bureau will be available to technical high schools and engineering colleges, as well as industrial plants. The program of instruction is introduced by a twenty-minute slide film which emphasizes, among other things, the importance of further study and education. This is followed by a lecture that is built around ten fundamental principles applying equally well to any type of machine tool operation. These principles are illustrated by large drawings that can be easily seen and understood by the audience. These ten fundamental principles, or "ten ways to get better results," are headed: Use proper speeds; use correct feeds and depth of cut; use a universal set-up; grip the work properly; combine cuts; use the best cutter grind; support the cut; know how to get accuracy; take care of your machine; and keep modern. It is suggested that those interested in this type of educational training program communicate with the Warner & Swasey Co., Cleveland, Ohio.

* * *

Gain in Gear Production

The American Gear Manufacturers Association, with headquarters at 602 Shields Bldg., Wilkinsburg, Pa., reports that gear sales for the month of April were 12 per cent above the sales in March, this year, and 45 per cent above those of April, 1939. For the four months ending with April, 1940, the sales were 30 per cent above those of the corresponding period in 1939.

Multiple "Oil-Wedge" Sleeve Bearing

A NEW type of sleeve bearing based on the principle of establishing a number of oil-film wedges, uniformly distributed around the journal, has recently been introduced by the Bartlett Hayward Division of Koppers Co., Baltimore, Md.

The development of this principle of bearing lubrication may be traced back to experiments made by Beauchamp Tower, which were analyzed by Professor Osborne Reynolds in 1886. These experiments were conducted with a shaft journal 4 inches in diameter, which was partly immersed in an oil bath, as shown in Fig. 1. Resting on the journal was a journal brass which subtended an arc of approximately 155 degrees.

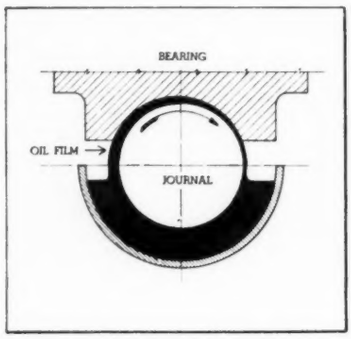


Fig. 1. Principle of Oil Wedge, Showing Oil being Dragged into Space between Bearing and Journal, Forming a Wedge-shaped Supporting Film

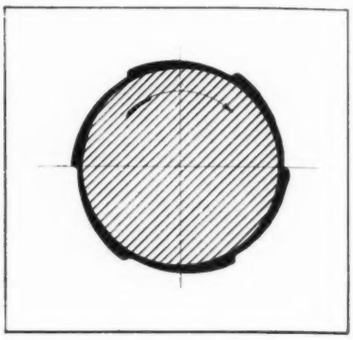


Fig. 2. Fast Multiple Oil-film Principle, Showing Lubrication of Sleeve Bearing by a Series of Equally Spaced Oil "Wedges" around Journal

It was found that the adherence of the oil film to its two boundary surfaces and its own viscous resistance to flow set up pressures that were large enough to actually float the load on oil. Thus, the tension between the lubricant and the rotating journal caused the oil to adhere to the latter and to be dragged into a wedge-shaped space between the journal and the bearing brass, as shown in Fig. 1. This oil-film wedge was thickest near the point of entrance of the oil, and tapered to a minimum at the point of exit in the direction of rotation.

It was subsequently proved that for any given bearing load, speed of rotation, and viscosity, there is one and only one wedge form that will support the load with maximum efficiency or with minimum frictional or shearing resistance in the oil film. The most efficient wedge form will be automatically assumed, however, if the two converging boundary surfaces are free to adjust themselves to varying operating conditions.

If it were practicable to provide several such wedge-shaped oil films, uniformly distributed around the journal, as shown in Fig. 2, it would seem to be a reasonable assumption that a radial bearing system so devised would have great load-carrying capacity combined with low frictional characteristics, regardless of the direction of loading normal to the axis of the journal.

Actually it was on this basis that Gustave Fast designed the multiple oil-film bearing and brought this principle into commercial application. In Fig. 3 are shown the three component parts of such a bearing. The outer sleeve, shown at the left, has a sliding fit in the bearing housing and a concave spherical bore. The inner sleeve has an outer boundary which is polygonal in general form, but the corners are machined to convex spherical contours which fit the spherical bore of the outer sleeve. The bore or bearing surface of the inner sleeve is cylindrical. The journal hub, shown at the right, has a cylindrical outer bearing surface and a straight bore for a shrink fit on its shaft.

The purpose of the spherical seating of the inner sleeve in the outer is to permit sufficient swiveling of the inner sleeve to align its bore accurately with the axis of rotation, despite shaft deflection or unavoidable errors in initial assembly alignment. Any tendency of the outer sleeve to rotate is restrained by a pin which engages a locating hole in the housing bore. This pin also projects through the outer sleeve and acts as a stop to prevent actual rotation of the inner sleeve, while permitting enough swiveling for alignment.

The distribution of oil between the inner sleeve and the journal hub is

Photo Holmes I. Mettee, Baltimore, Md.

Fig. 3. Outer Sleeve, Inner Sleeve, and Journal Hub of the Fast Multiple Oil-film Bearing

effected as follows: In rotating, the journal hub acts as a pump rotor which draws oil up from the reservoir at the bottom of the housing through supply ducts terminating in the two lower transverse grooves shown at the bottom of the inner sleeve in Fig. 3. These and similar transverse oil-grooves, equally spaced in pairs around the bore, communicate at each end with circumferential oil distributing ducts. Rotation of the journal hub forces oil under adequate pressure across the full width of its own bearing surface and in direct contact therewith through the transverse oil-grooves spaced around its periphery. Adherence of this oil to the rotating outer surface of the journal hub causes it to be dragged in between the bearing faces of the journal hub and the inner sleeve in sufficient quantity for the establishment of the required oil films. The design of the inner sleeve permits the formation of oil-film wedges of the proper form for any given loading, because the inner sleeve is free to deflect between its spherical contacts with the outer sleeve as a result of internal oil pressure. The section moduli of the deflecting elements are so proportioned that a given bearing load will produce an angular deflection requisite for the most efficient oil-film wedge to support it.

The journal hub is made of hardened and accurately ground steel, while the bore of the inner sleeve has a soft metal facing to allow impurities in the oil to embed themselves in it without disrupting the oil film and impairing the efficient operation of the bearing. This soft or "plastic" metal facing has a steel backing of adequate strength to support the loads imposed upon it. The outer sleeve is of unhardened steel, since its function is a relatively simple one.

To resist end float, auxiliary location bearings are also available which function on the same multiple oil-film wedge principle. As shown in Fig. 4, the back of the location bearing has a convex spherical seating surface for self-aligning purposes, which transmits its thrust to a concave seat in the bearing housing, thus restricting lateral float of the radial bearing hub to any desired tolerance. Rotation of the location bearing is restrained by retainer clips which do not interfere with its swiveling action.

The locating bearing surface is supported at equally spaced intervals around the circumference by the narrow necks which connect the bearing surface and the back seating ring, so that deflection between these supports permits oil wedges of the best form for a given axial load.

The life of this type of bearing is not dependent upon speed and load within its rated capacity, for load capacity increases with speed and is normally as great as that of the shaft. It is stated that these bearings in a sealed housing will run continuously for a year on a single filling of oil.

* * *

Colonial Broaching Equipment in a Buick Operation

In the article "Tool Engineering in the Buick Plant, in April MACHINERY, it was mentioned that the operation shown in Fig. 8 on page 140, was performed on an Oilgear vertical, hydraulic broaching machine. It should also have been stated that the broaches and work-holding fixture were produced by the Colonial Broach Co., Detroit, Mich.

* * *

Greater New York Chapter of Tool Engineers Formed

The thirty-fourth Chapter of the American Society of Tool Engineers was chartered at Pratt Institute, in Brooklyn, N. Y., on May 8. The officers of the Chapter are: A. J. Duncan, of the E. W. Bliss Co., Brooklyn, chairman; Thomas Orchard, of the Herbert D. Hall Co., Newark, N. J., vice-chairman; A. J. Schwister, of the Greenfield Tap & Die Corporation, New York City, treasurer; and H. L. Horton, of MACHINERY, secretary. Over eighty applications for membership had been approved at the date of chartering, and more than one hundred tool engineers were expected to join before June 8, the limiting date for charter members.

The charter was presented by A. H. d'Arcambal, of the Pratt & Whitney Co., Hartford, Conn., national president of the Society. Ford Lamb, executive secretary, gave an address on the origin, purposes, and activities of the Society. Meetings of the new Greater New York Chapter will be held on the second Monday of each month at the Hotel Governor Clinton in New York.

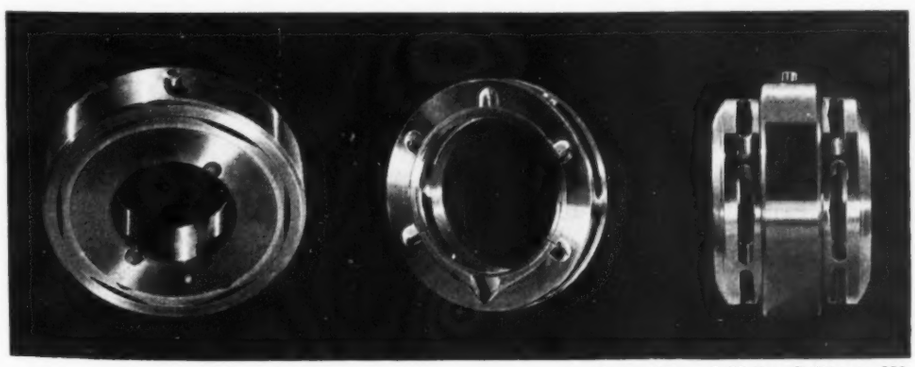
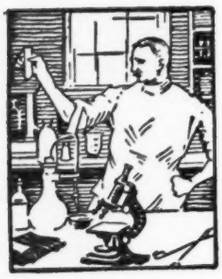


Photo Holmes I. Mettee, Baltimore, Md.

Fig. 4. Assembled Radial Bearing; Location Bearing to Take End Thrust; and Assembly of Radial and Location Bearings

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Cobalt-Chromium-Tungsten Alloy Steels for Wear Resistance

The adoption of cobalt-chromium-tungsten alloy steels for cutting tools and wear strips is becoming more and more widespread. Many machine tools for turning brake-drums and for reseating valves in automotive engines are now equipped with cobalt-chromium-tungsten steel tools. Standard wear strips consisting of machine steel bars to which this wear-resistant alloy is brazed assure continued accuracy and long life for boring, driving, and pilot bars used in metal-cutting operations. 201

Oxy-Acetylene Welding Materials for Use at Low Temperatures

A new welding material known as Castolin which enables oxy-acetylene welding to be accomplished at unusually low temperatures has been introduced by the Park Sales Co., 3 Park Place, New York City. By the use of this material, overheating and subsequent warping of welded parts are avoided, stresses are eliminated, and lengthy preheating in repair work is unnecessary.

Castolin is furnished in rod form in a variety of alloys suitable for different uses. Among the outstanding alloys are the following:

No. 190 for welding aluminum and its alloys, even in very thin sheets, is particularly useful to the aviation and automobile industries. This alloy flows at 930 degrees F., and has a tensile strength of 35,000 pounds per square inch, as well as high durability.

"Bronzochrome" (No. 185) can be used in building up steel, cast iron, copper, brass, bronze, etc., and because of its easy machinability is especially applicable for repairing broken or worn out parts of machinery. This alloy flows at 750 degrees F., and has a hardness of 230 Brinell.

No. 14 is suitable for cast iron. It binds at 900 degrees F., and has a tensile strength of 47,000 to 51,000 pounds per square inch. No. 15, another alloy adapted for welding cast iron, binds at 360 degrees F., and is resistant to eight atmospheres pressure.

No. 16 is recommended for steel, particularly thin-gage. It binds at 1470 degrees F., and has a tensile strength of 115,000 pounds per square inch.

No. 18 may be applied to copper, brass, and extruded bronze. It binds at 1600 degrees F., and has a tensile strength of 65,000 pounds per square inch.

No. 210 is suitable for cast aluminum. It binds at 950 degrees F., and has a tensile strength of 23,000 pounds per square inch.

No. 195 has been developed for die-casting (white metal). It binds at 750 degrees F.

Castolin fluxes are also available, in either powder or paste form. 202

Nickel-Alloy Iron Used for Airplane-Engine Castings

Cylinder and crankcase castings of light-weight aircraft engines built by the Lycoming Division, Aviation Mfg. Corporation, Williamsport, Pa., are made from a high-test electric furnace iron containing 3.10 per cent carbon, 2.10 per cent silicon, 1.50 per cent nickel, 0.30 per cent chromium, and 0.50 per cent molybdenum. Tensile strengths of over 50,000 pounds per square inch, together with a Brinell hardness averaging 240, are shown by these motor parts. Good wearing qualities, coupled with resistance to growth and warpage, are said to provide added usefulness. 203

Bonding Rubber and Neoprene to Steel and Aluminum

A method of bonding soft rubber and Neoprene to steel and aluminum by hot vulcanizing, which results in high adhesion strength and good aging qualities, has been developed by the Hewitt Rubber Corporation, Buffalo, N. Y. This process, called "Dura-bond," is based on subjecting the rubber to a chemical treatment which modifies its composi-

To obtain additional information about materials described on this page, see lower part of page 148.

tion in such a manner that it will attach itself integrally to the metal without impairing the capacity of the rubber to be vulcanized to the outer rubber layer. The use of a hard rubber base next to the metal and brass-plating of the metal are thereby eliminated. Applications thus far are limited to temperatures not exceeding 200 degrees F., although efforts are being made at present to extend this range. 204

New Copper-Iron Alloy for Spot-Welding Tips

A copper-iron-cobalt alloy named Cuferco having an electrical conductivity of about 70 per cent that of copper and a tensile strength approximately equal to that of hot-rolled, low-carbon machinery steel has recently been brought out by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Because of its iron content, this alloy can be hardened by heat-treating, and is softened very little by repeated applications of heat. It is particularly suitable for such applications as tips for spot-welders. Its tensile endurance limit is 23 per cent higher than that of Cupaloy, a previously developed alloy of a somewhat similar type.....205

Pickleen—A New Material Used for Clean, Economical Acid Pickling

A new liquid wetting and penetrating agent which is added to sulphuric or hydrochloric acid pickling solutions to reduce their surface tension and to give them the same wetting and penetrating action as alkaline detergents has been brought out by the Enthone Co., makers of chemical products, New Haven, Conn.

The new product, known as Pickleen, is added to acid dips or pickling solutions made of sulphuric or hydrochloric acid in the proportion of about one pint of Pickleen to fifty gallons of acid solution. It is used (1) in pickling solutions for cleaning rust or scale; (2) in acid dips before plating to insure clean work and to prevent peeling or blistering of the plate; it is especially recommended for bulk or basket pickling previous to barrel plating; (3) for pickles employed previous to hot-galvanizing, hot-tinning, rustproofing, painting, enameling, or japanning; and (4) as an addition to acid fluxes to insure penetration and rapid, uniform action. Pickleen is a non-inflammable, almost odorless liquid that is harmless to the skin.....206

Alloy Provides Increased Safety for Marking Tools

Protection against spalling and mushrooming in marking tools—often the cause of serious industrial accidents—is now afforded by the use of silicon-molybdenum-vanadium steel, according to the Vanadium Corporation of America, New York City. This steel has the following analysis: Copper, 0.55 per cent; manganese, 1.04 per cent; silicon, 2 per cent; molybdenum, 1.33 per cent; and vanadium, 0.50 per cent. It is stated to have an ultimate strength of 350,000 pounds per square inch; a reduction of area of 12.5 per cent; and a hardness of 60 Rockwell C. The increased strength of this new alloy permits the use of lighter tools and stamps. 207

Sealing Compound for Hydrocarbon Pipes and Containers

A sealing compound for use in joints of pipes and containers carrying propane, pentane, butene, benzol, gasoline, naphtha, grease, and oils of all types has recently been introduced on the market under the trade name "Glycoseal" by the Glyco Products Co., Inc., New York City. This material is flexible, leakproof, and non-cracking. It will not harden, so that joints once formed can be broken easily without damage to the fittings. It can be used on rubber without deleterious effect, as well as on all types of metals.

In order to test the efficacy of the new sealing compound, it was used in making up a manifold of 1/2-inch pipe fittings, including nipples, tees, elbows, and plugs. The manifold was connected directly to a propane cylinder and the cylinder was then turned on end, filling the manifold with liquid. At the end of a week, only one joint showed slight leakage. The same test was applied to propane gas at 20 pounds pressure for one week, and no leaky connection was noted.....208

Pre-finished Aluminum Sheets with Bonded Nickel or Chromium Coatings that do not Peel are being Made in a Variety of Patterns and Finishes by the American Nickeloid Co., of Peru, Ill.

To obtain additional information about materials described on this page, see lower part of page 148.

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 147 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the June Number of MACHINERY

Electrical Equipment

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburgh, Pa. Second edition of the "Quick Selector" catalogue 30-000, prepared to help the user of electrical equipment select the correct apparatus for any motor, lighting, or feeder circuit. Leaflet 3113, on fractional and integral horsepower repulsion-start induction motors for heavy-duty industrial service. Booklet 8522, on heavy-duty magnetic time-starters. Bulletin F-8548, on a.c. and d.c. fractional-horsepower motors. 1

Electrical Equipment

GENERAL ELECTRIC Co., Schenectady, N. Y. Circulars GEA-1368D, 1412B, 1607C, 2742A, 2902B, 2924, 3223, and 3345, on shielded induction motors; direct-current generators and exciters; pyranol capacitors; vacuum-tube time-delay relays; induction type dynamometers; single-phase vertical motors; and synchronous motors and control for part-winding starting. 2

Turret Lathe Tools

GISHOLT MACHINE Co., 1209 E. Washington Ave., Madison, Wis. Catalogue 1059B containing 40 pages covering the entire line of standard tools for ram type turret lathes. Catalogue 1066B, covering Gisholt standard tools for 1L, 2L, and 3L high-production turret lathes, including data of value in selecting the correct tool for different classes of work. 3

Testing Equipment

BALDWIN SOUTHWARK DIVISION OF THE BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa. Bulletins 153, 154 and 155, treating, respectively, of strain gages and extensometers; Carpenter torsion impact machine for testing brittle materials; and SR-4 bonded Metalectric strain gage employing a new principle for measuring static and dynamic stresses. 4

Shapers

CINCINNATI SHAPER Co., Cincinnati, Ohio. Catalogue N-1, describing the Cincinnati line of power rapid-traverse, universal, Utility, and high-speed shapers, and their improved features. Complete specifications are included for the various sizes, which cover a range suitable for any service. 5

Carboloy Tools

CARBOLOY COMPANY, INC., 11147 E. 8 Mile Blvd., Detroit, Mich. Booklet describing how the Warner & Swasey Co. of Cleveland has applied Carboloy tools throughout its plant on approximately 1500 small-lot jobs. The eight standard tools used for most of the jobs are shown and speed and feed data are included. 6

Stainless Steel

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa. Blue Sheets Nos. 101 to 107, inclusive, containing technical information on Allegheny Ludlum chrome and chrome-nickel iron alloys for applications where resistance to corrosion, oxidation, and heat is important. 7

Grinding-Wheel Dressers and Cutters

CALDER MFG. Co., 626 N. Prince St., Lancaster, Pa. Catalogue 38, describing the special features of the Calder hooded grinding-wheel dresser equipped with milled cutters and renewable, hardened-steel, threaded bushings. 8

Belting and Leather Packings

GRATON & KNIGHT Co., Worcester, Mass. Catalogue containing belting data of value in selecting the proper belt for various types of drives. Catalogue containing information on the different types of Spartan leather packings and their application to suit various requirements. 9

Guide to Uses of Nickel Alloys

INTERNATIONAL NICKEL Co., INC., 67 Wall St., New York City. Booklet entitled "Seven Minutes with Seven Metals," containing information on the properties and uses of nickel, Monel, Inconel, and other high-nickel alloys in mill, clad, and fast forms 10

Single-Crank Presses

NIAGARA MACHINE & TOOL WORKS, 637-697 Northland Ave., Buffalo, N. Y. Bulletin 63-C, covering the complete line of Niagara Series 50 single-crank presses for the production of heavy stampings requiring a concentrated pressure. 11

Wire-Wheel Brushes

VAN DORN ELECTRIC TOOLS, DIVISION OF BLACK & DECKER MFG. Co., 735 Joppa Road, Towson, Md. Circular descriptive of "Whirlwind" wire-wheel brushes, available in a wide range of sizes and wire gages for any application. 12

Cutting Oils

SUN OIL Co., Philadelphia, Pa. Bulletin containing production data on Sunicut cutting oil, suitable for gear-cutting, threading, tapping, knurling, and other operations on automatic screw machines and gear-cutting machines. 13

Electrical Tools

UNITED STATES ELECTRICAL TOOL Co., Cincinnati, Ohio. Catalogue 56, covering the complete line of electrical tools manufactured by this company, including electrical buffers, grinders, drills, screwdrivers, tappers, saws, etc. 14

Area Determinator

AMERICAN INSTRUMENT Co., 8010 Georgia Ave., Silver Spring, Md. Bulletin 2081, descriptive of the Aminco area determinator for measuring the areas of any flat object,

either regular or irregular in shape, by the photo-electric method. 15

Filing in the Lathe

NICHOLSON FILE CO., Providence, R. I. Bulletin on "Lathe Filing," covering method of holding the file; pressure to be used; and theory of the long angle and why it prevents pinning up and scratching. 16

Ball Bearings

FAFNIR BEARING CO., New Britain, Conn. Condensed catalogue 35X (6 1/4 by 8 1/2 inches), containing detailed information on the complete line of Fafnir ball bearings, of value to any bearing user. 17

Electric Planer Drives

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Booklet B-2214, describing variable-voltage planer drives, and showing examples of increased production obtained with this equipment. 18

Carbide Steel-Cutting Tools

FANSTEEL METALLURGICAL CORPORATION, North Chicago, Ill. Bulletin G-401, entitled "Tantung Oxy-acetylene Welded Tip Tools for Cutting Steel." Bulletin G-402, on tantung brazed tip tools for cutting steel. 19

Washer-Selecting Slide-Rule

WROUGHT WASHER MFG. CO., 2100 S. Bay St., Milwaukee, Wis., is distributing a slide-rule by means of which washer sizes can be quickly selected to best suit a given design or assembly requirement. 20

Saw Manual

PORTER-CABLE MACHINE CO., Syracuse, N. Y. Saw Manual No. 2, entitled "How to Cut Costs and Increase Profits," containing much information of value to the users of electric hand saws. 21

Gearmotors

RELIANCE ELECTRIC & ENGINEERING CO., Ivanhoe Road, Cleveland, Ohio. Bulletins 403 and 404, on single-reduction gearmotors, and double- and triple-reduction gearmotors, respectively. 22

Screw Threads

AIRCRAFT SCREW PRODUCTS CO., INC., 25-12 Forty-first Ave., Long Island City, N. Y. Bulletin T-1, describing the "Aero-thread" screw thread system—the thread with an anti-friction thread lining. 23

Pliers

WILLIAM SCHOLLHORN CO., New Haven, Conn. Engineering specification handbook containing full-size, detailed drawings of all of the Bernard pliers and plier-action tools made by the company. 24

Sheet Handling Equipment

CULLEN-FRIESTEDT CO., 1305 S. Kilbourn Ave., Chicago, Ill. Circular showing many different applications of the C-F sheet lifter designed to handle sheet material quickly and easily. 25

Grinding Practice

NORTON CO., Worcester, Mass. Folder entitled "Norton Consulting Engineering Service," indicating how 1800 consultants help solve industrial grinding problems. 26

Toolmakers' Magnetic Block

BROWN & SHARPE MFG. CO., Providence, R. I. Circular entitled "A Handful of Holding Energy," descriptive of the B & S toolmakers' magnetic block. 27

Pipe and Tube Bending Equipment

PARKER APPLIANCE CO., 17325 Euclid Ave., Cleveland, Ohio. Bulletin 40E, on pipe benders and tube fabricating equipment. 28

Snagging Wheels

ABRASIVE CO., Tacony and Fraley Sts., Philadelphia, Pa. Bulletin ESA-62, dealing with abrasive snagging wheels for fast production in foundry and billet grinding. 29

Welders' Helmets

SELLSTROM MFG. CO., 615-649 N. Aberdeen St., Chicago, Ill. Folder illustrating and describing rounded-front, molded welders' helmets with outstanding new features. 30

To Obtain Copies of New Trade Literature

listed on pages 146-148 (without charge or obligation), mark with X in the squares below, the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	

Name ..... *Position or Title* .....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

Firm .....

Business Address .....

City ..... *State* .....

[SEE OTHER SIDE]

Solid Adjustable Die-Heads

GEOMETRIC TOOL CO., New Haven, Conn. Bulletin EJ5-1, illustrating and describing Geometric 3/16-inch solid adjustable die-heads for small-diameter, fine-pitch threads. 31

Hydraulic Cylinders

HANNIFIN MFG. CO., 621-631 S. Kolmar Ave., Chicago, Ill. Bulletin 35-B, describing Hannifin improved type hydraulic cylinders, made in seven standard mounting types. 32

Machine Shop Equipment

IDEAL COMMUTATOR DRESSER CO., 1011 Park Ave., Sycamore, Ill. Circulars covering "Ideal" live centers; brush type wire strippers; and "wire nuts." 33

V-Belt Drives

MEDART COMPANY, 3538 DeKalb St., St. Louis, Mo. Bulletin 84-E, showing new belt ratings of Medart V-belts, which permit more precise and economical selection of V-belt drives. 34

Motor Design and Operation

U. S. ELECTRICAL MOTORS, INC., 200 E. Slauson Ave., Los Angeles, Calif. Booklet containing information on the design and operation of U. S. single-phase motors. 35

Speed Control Equipment

GEORGE SCHERR CO., INC., 128 Lafayette St., New York City. Catalogue entitled "The Control of Speed," devoted to hand tachometers, speed indicators, cutmeters, and similar equipment. 36

Roller Bearings

BOWER ROLLER BEARING CO., 3040 Hart Ave., Detroit, Mich. Circular describing the principal design features of Bower tapered roller bearings. 37

Weighing Scales

EXACT WEIGHT SCALE CO., Columbus, Ohio. Leaflet showing applications of "Exact Weight" Shadowgraph scales in balancing connecting-rods and gaging pistons. 38

Retainer Rings

RELIANCE SPRING WASHER DIVISION OF EATON MFG. CO., Massillon, Ohio. Catalogue containing engineering data on snap, bearing, lock, and retainer rings. 39

Mercury Clutches

MERCURY CLUTCH CORPORATION, Massillon, Ohio. Catalogue descriptive of a new type of clutch actuated by mercury, which eliminates starting shock. 40

Variable-Speed Transmission

LENNEY MACHINE & MFG. CO., Warren, Ohio. Bulletin on the new Lenney variable-speed transmission, with infinite and instantly adjustable speed. 41

Industrial Washing and Cleaning Equipment

INDUSTRIAL WASHING MACHINE CORPORATION, New Brunswick, N. J. Catalogue on industrial washing, cleaning, rinsing, and drying machines. 42

Tachometers

O. ZERNICKOW CO., 15 Park Row, New York City. Circular descriptive of a new line of improved stationary tachometers for measuring the speed of revolving objects. 43

Welding Electrodes

WILSON WELDER & METALS CO., INC., 60 E. 42nd St., New York City. Catalogue ADW-18, describing arc-welding electrodes. 44

Engraving Machines

H. P. PREIS ENGRAVING MACHINE CO., 155 Summit St., Newark, N. J. Bulletin on master copy type for pantograph engraving machines. 45

Oscillating Tapping Machine

L. J. KAUFMAN MFG. CO., Manitowoc, Wis. Bulletin 727, illustrating and describing a new pneumatic oscillating tapping machine. 46

V-Belt Drives

L. H. GILMER CO., Tacony, Philadelphia, Pa. Ninety-six page catalogue giving detailed information on V-belt drives. 47

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 149-166 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on pages 149-166 — or write directly to the manufacturer, mentioning machine as described in June MACHINERY.

51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 144-145, mark with X in the squares below, the identifying number found at end of each description on pages 144-145 — or write directly to the manufacturer, mentioning name of material as described in June MACHINERY.

201	202	203	204	205	206	207	208

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Oilgear Twin Horizontal Broaching Machine

A new style fluid-power, variable-speed, twin type, horizontal broaching machine incorporating the most recent developments in design, control, and operating features is now being manufactured by the Oilgear Co., 1315A W. Bruce St., Milwaukee, Wis. Simple push-button control designed to lessen operator fatigue is an outstanding feature of this machine, no effort or skill being required to perform complex operations. The machine can be controlled from either side by one or two operators. Simply depressing one button starts the broaching stroke of one cross-head and the return stroke of the other. Both of the operator's hands are free for handling the work and tool, the cross-head motions being controlled by the alternative toe-lever switches located on each side of the machine. The machine will pull peak loads equal to 150 per cent of the normal capacity. Preset relief valves built in the pump protect the work, tools, pump, and machine against overloads.

Oilgear twin horizontal broaching machines are especially adapted for high-speed internal and external broaching operations on small and medium-sized parts. The two rams work alternately, one operating on the return stroke while the other is pulling, so that the production is limited only by the operator's ability to serve the machine. Ample space is provided on the faceplate for mounting duplicate fixtures.

An emergency-stop push-button is provided on each side of the machine, and there is an independent variable broaching speed control for each cross-head. The steel cross-heads have long-wearing replaceable bronze liners guided on steel ways. These ways and liners have gravity and capillary feed lubrication. Vertical adjustments are provided for the pullers. The dual bored and honed steel cylinders are attached to the alloy iron trough by means of flanges. The all-steel welded frame supports the trough, cylinders, main pump, motor, and coolant pump. It also contains ample reservoirs for the oil and coolant, and encloses the operating mechanism, motor, and pump.

The normal pulling capacity is 12,000 pounds, while the peak capacity is 18,000 pounds. Cutting and return speeds range from 4 to 30 feet per minute. The broaching stroke is 36 inches; the hole in the faceplate, 4 inches in diameter; and the distance between cross-heads, 10 inches. The distance between the ways is 6 inches. A 10-H.P. motor with a speed of 1200 R.P.M. is recommended. A floor space of 34 by 142 inches is required for the machine, which weighs approximately 3900 pounds.

The particular machine shown in Fig. 2 is equipped for broaching the hole and keyway in spiral, left-hand, 20-tooth, cast-iron crankshaft gears, the hole being broached in one position and the keyway in the other. Approximately 0.032 inch of stock is removed from the 1.10-inch hole with the right-hand tool. A keyway 0.20 inch wide by 0.09 inch deep is broached 38 degrees from the center line of one of the gear teeth with the tool shown in the left-hand position. This machine performs 240 operations, finishing 120 gears per hour. The automatic puller on the right-hand cross-head simplifies tool handling and reduces loading time. 51

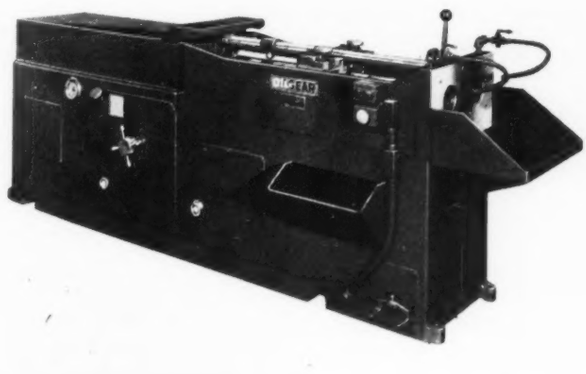


Fig. 1. Oilgear Variable-speed Twin Horizontal Broaching Machine

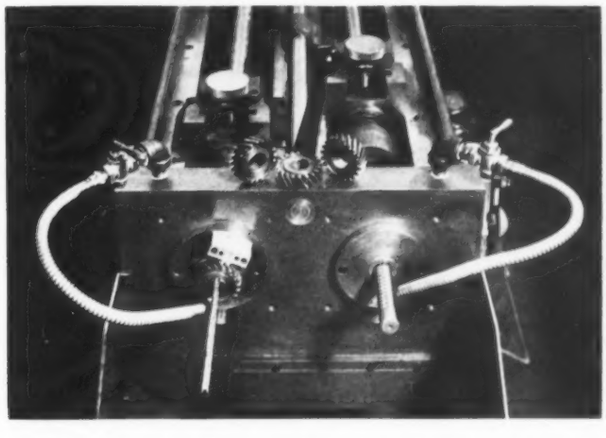
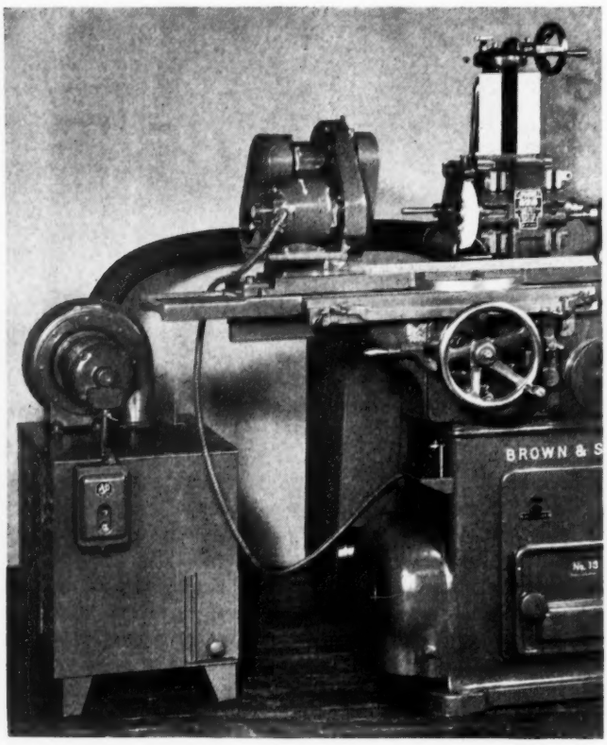
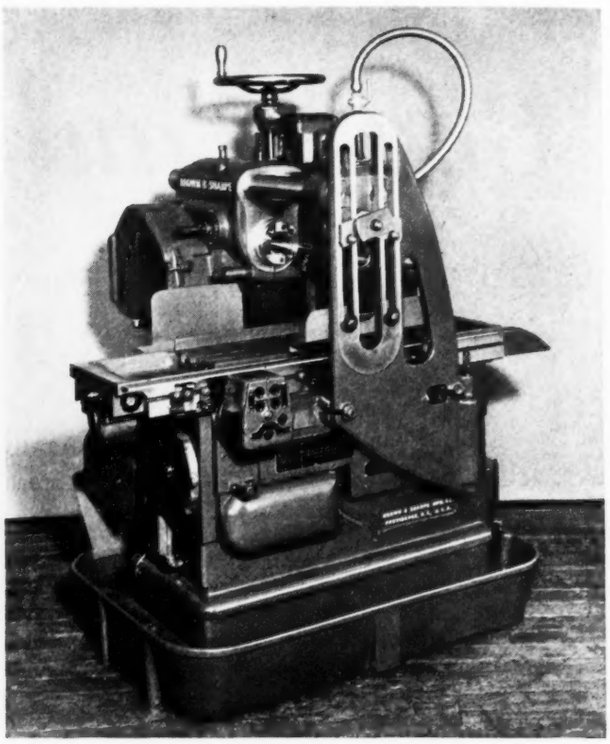


Fig. 2. Twin Broaching Machine Equipped for Broaching Hole and Keyway in Gear

To obtain additional information on equipment described on this page, see lower part of page 148.



Brown & Sharpe Grinding Machine Equipped with Exhaust Attachment



B & S Electrically Controlled Milling Machine of Increased Capacity

Exhaust Attachment for B & S Cylindrical Grinding Machine

A motor-driven attachment for removing grit and dust-laden air from the region of the grinding wheel by suction, which separates the foreign matter and leaves the air thoroughly clean, has been brought out by the Brown & Sharpe Mfg. Co., Providence, R. I., for use on the B & S No. 13 universal and tool grinding machine. It is intended for use with straight and dish type wheels, and can be applied at either end of the wheel-spindle.

The attachment includes an exhaust nozzle, flexible suction hose, and dust collector unit consisting of a motor-driven fan mounted on a separator tank. The dust-laden air is blown into a spiral separator, where the heavier particles are removed by centrifugal force. The air is then spread by a baffle in an expansion chamber, so that the dust is slowly dispersed over the whole area of the outlet filter, where the remaining finer particles are trapped by two fire-resistant, viscous-coated, renewable filter pads. Tests have shown that this dust collector unit has a separating efficiency of over 99 per cent.

The fan is driven by a 1/4-H.P. motor controlled by a starting switch having overload protection. The suction hose is made of a wire helix embedded in rubber, and has a fabric covering. The capacity of the attachment when driven by a 3600-R.P.M. motor is 300 cubic feet per minute, giving a velocity of approximately 6000 feet per minute through a 3-inch diameter hose. The attachment weighs about 200 pounds. 52

B & S Electrically Controlled Milling Machines

The No. 12 electrically controlled plain milling machines previously built by the Brown & Sharpe Mfg. Co., Providence, R. I., for the production milling of medium-sized work have recently been brought out in models having increased capacity. The height of the column has been increased 4 inches to provide a corresponding increase in the vertical adjustment of the spindle, the total vertical travel now being 10 1/2 inches. The width of the base has also been increased 2 1/2 inches, so that the horizontal working space now measures 17 13/16 inches from the face of the spindle head to the arbor yoke support.

Fixtures and work-pieces of proportionately larger size can be handled on the improved machine with no sacrifice in efficiency or increase in power consumption. The design and construction features of the preceding machines have been retained, although many minor improvements and refinements have been made. The floor space requirements and the net weight of the machine have been increased slightly. 53

Cross Gear-Tooth Pointing Machine

The Cross Gear & Machine Co., 3250 Bellevue Ave., Detroit, Mich., has brought out a machine for pointing the teeth of sliding helical gears to an included angle of less than 90 degrees, in order to reduce wear on the gears and to promote easier, quieter gear shifting. The new No. 62 machine has two cutter-spindles in adjustable angular relationship with the gear. One cutter bevels one side of all the teeth, while the other cutter bevels the opposite side of all the teeth.

An entirely new method is used for rotating the cutters and work at

To obtain additional information on equipment described on this page, see lower part of page 148.

high speed in synchronized timed relationship, so that their relative motions are combined to generate the desired form on the ends of the gear teeth. Two gear teeth are cut at each revolution of the cutters, which are relieved so that one gear tooth is passed through the gap in each cutter at each revolution, thus making it possible to point 1500 teeth per minute under normal operating conditions. The average 7-pitch gear with 30 teeth is completed at the rate of 160 per hour.

Pitch changes and modifications of form are made by changing the inside contour of the cutter. Indexing changes are made quickly by means of standard change-gears. Features such as calibrated universal adjustments, adjustable hydraulic feed, timing synchronizer, and standard work-holding fixtures are incorporated in the machine to give it flexibility and versatility. Only a few minutes are required for changing cutters. The machine will handle 4-pitch or finer gears up to 12 inches in diameter, with a face width of 12 inches. It occupies a floor space 50 by 59 inches, and weighs 6200 pounds. 54

Hannifin Combination Tool-Room Machine

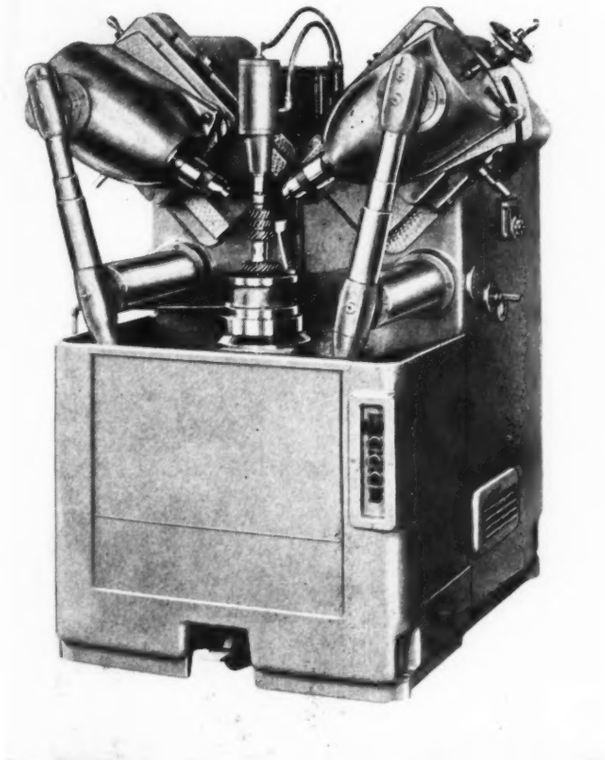
The new No. 10 tool-room machine brought out by the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill., combines in one unit a precision lathe, a sensitive drill press, a horizontal milling machine, and a vertical milling machine. Four standard tool-room machines are thus available in one compact, versatile machine. Most machining operations on tool-room jobs can be performed on this machine with a substantial saving in time. The machine can also be used to advantage for the economical production of many parts manufactured in small quantities.

The lathe unit is a precision type tool-room machine with a rigid bed mounted on a heavy base. The tailstock has ground gibs on all bearing surfaces. The spindle is ball-bearing mounted, and takes adapters having B & S No. 10 taper shanks. The compound slide has simple, rapid adjustment. A 4-inch, three-jaw universal chuck is mounted on the spindle, and there is a three-jaw, 1/2-inch Jacobs chuck for the tailstock.

The sensitive drill press unit has simple, easily accessible controls and a 9-inch adjustable table. Both rapid hand-feed and a worm-drive feed with a dial having 0.001 inch graduations are provided. The spindle is mounted in ball bearings and the heavy quill is hardened and ground.

The horizontal milling machine is a precision built unit designed for easy handling, and is adapted for all classes of tool-room work. A large handwheel with micrometer scale provides for rapid vertical feed. The lead-screws are equipped with micrometer scales. The spindle is made of chrome-nickel steel and is mounted in ball bearings. The table is fitted to long bearings with an adjustable gib.

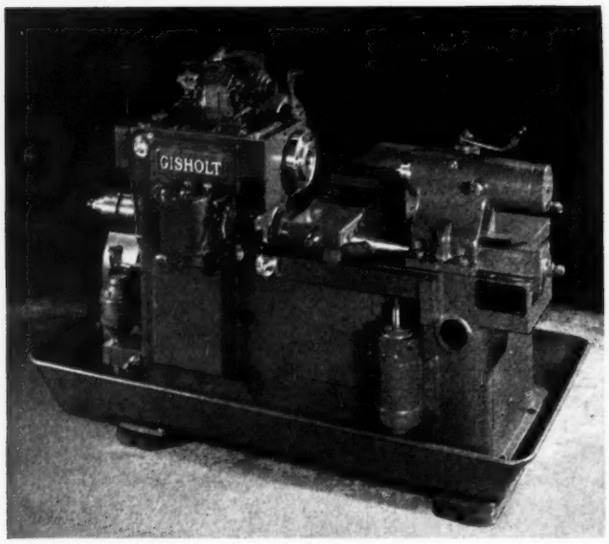
The vertical milling machine is adapted for handling a complete range of milling work. Precision horizontal, vertical, and cross feeds have handwheels fitted with micrometer scales. The single-screw vise has a swivel base. This machine can be arranged for screw-cutting with a quick-change gear-box that also provides power feed for the saddle. The machine has a capacity for cutting threads up to 18 inches long. 55



Cross Two-spindle Gear-tooth Pointing Machine Designed for Rapid Production

Tool-room Machine Comprising Precision Lathe, Sensitive Drill, and Milling Machine Units

To obtain additional information on equipment described on this page, see lower part of page 148.



Gisholt Hydraulic Automatic Lathe of Improved Design for Between-centers and Chucking Work

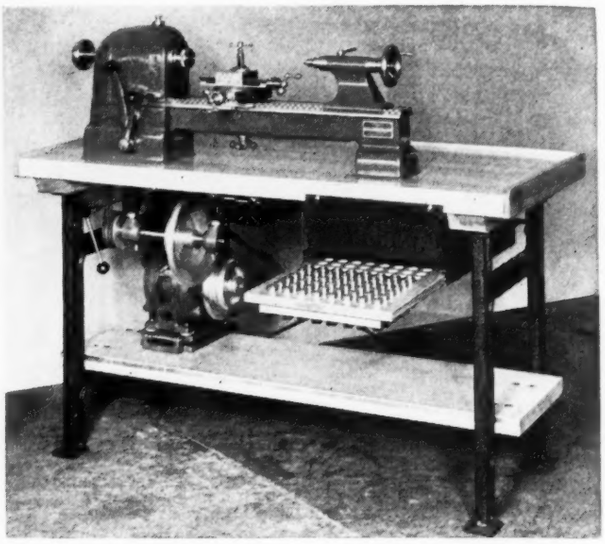


Fig. 1. Bench Lathe and Bench Lathe Unit Developed by the Elgin Tool Works

Gisholt Hydraulic Automatic Lathe

A new No. 12 hydraulic automatic lathe for between-centers and chucking work has been brought out by the Gisholt Machine Co., 1209 E. Washington Ave., Madison, Wis. This machine is adapted for a wide range of production turning work, such as finishing cluster and bevel gear blanks, turning fins on airplane engine cylinders, machining cylinder liners, finish-turning and grooving aluminum pistons, etc.

This lathe has a swing of 16 3/4 inches over the bed and 12 inches over the front carriage. The length between centers is 22 inches—4 inches more than in the previous No. 12 Gisholt hydraulic automatic lathe described in October, 1939, MACHINERY, page 92.

The front carriage has a longitudinal travel of 7 inches, and the rear slide also has a travel of 7 inches. The regular spindle speeds range from 62 to 335 R.P.M., but other speed ranges can be furnished. Independent feeds are provided for the front carriage and rear slides, the hydraulic system giving smooth, constant feeding movements with an infinite selection of feeds from 0 to 0.060 inch. The machine occupies a floor space of 4 feet 10 inches by 7 feet, and weighs 5500 pounds. 56

Elgin Bench Lathe and Bench Lathe Unit

The Elgin Tool Works, 1770 W. Berteau Ave., Chicago, Ill., has recently developed the bench lathe and bench lathe unit shown in Fig. 1. Two noteworthy improvements have been incorporated in this lathe. The first of these is an arrangement whereby the cap that covers the driving belts can be removed, as shown in Fig. 2, to enable belts to be changed without dismantling the machine. With the cap removed, it is merely necessary to loosen two adjusting screws that level the jack-shaft beneath the bench, in order to raise the sheave end of the jack-shaft so that new belts can be slipped into place. Having done this, the jack shaft can be realigned quickly by means of the adjusting screws.

The other important new feature of the lathe is the provision of two conveniently placed levers, one of which is thrown to the left for low speed, to the right for high speed, and to the center for stopping the lathe. The second lever is thrown to the right for forward, to the left for reverse, and to the center to stop the spindle rotation.

The entire drive is under the bench. A lever with ample power provides for raising the motor to permit shifting the belt from step to step on the pulleys. This lever is pulled forward past a dead center, to hold the motor in its elevated position, leaving both of the operator's hands free to change the belt. By pushing the lever back, the motor is again positively locked in its driving position, with the necessary tension on the belt.

The bench is heavily constructed of hard maple, well finished, the bare top weighing 135 pounds. The top is 54 inches long by 29 inches wide.

These lathes are built in 1/2-, 3/4-, and 1-inch sizes. A convenient collet board is provided, which can be drawn out from under the bench drawer. The collet board of the 1/2-inch machine contains 32 collets, that of the 3/4-inch machine 48 collets, and that of the 1-inch machine 64 collets. The sizes of the collets for each machine vary by 1/64 inch. 57

Lovejoy Heavy-Duty Flexible Coupling

The Lovejoy Flexible Coupling Co., 5021 W. Lake St., Chicago, Ill., is manufacturing a new type non-lubricated, heavy-duty flexible coupling designated L-R Type H. This new coupling is cast from high-grade electric steel, has a greater number of jaws than previous L-R types, and

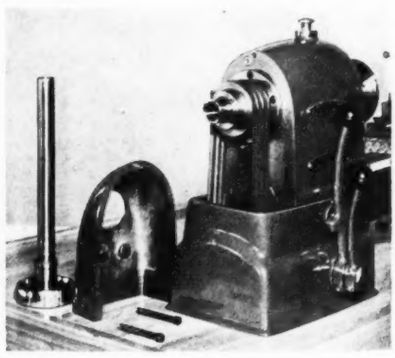


Fig. 2. Elgin Lathe Head with Cover Removed

To obtain additional information on equipment described on this page, see lower part of page 148.

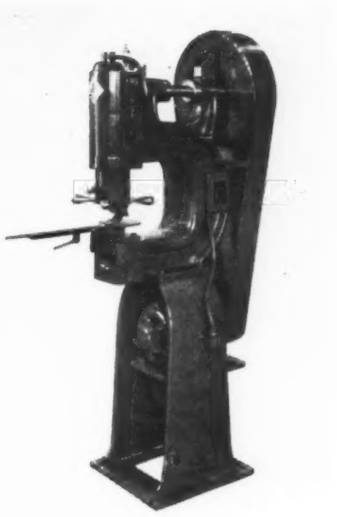
is claimed to have an 80 per cent greater load-carrying capacity. The load cushions are free-floating between the metal jaws, and rest upon the central hub, being held in place by a floating retainer. The cushions are always in plain sight for inspection, and can be quickly replaced.

Three types of resilient cushioning materials are available for different requirements. These couplings are made in sizes with bores from 1 1/2 to 14 inches in diameter, for transmitting from 5 to 3000 H.P. at 100 R.P.M. 58

Savage Nibbling Machines

The W. J. Savage Co., Knoxville, Tenn., has recently incorporated improvements in its line of nibbling machines. The improvements include a direct over-center drive, which gives the machines additional power, and a totally enclosed revolving head, which simplifies operations. The machines are designed for fast and accurate cutting of sheets of any thickness up to 1/2 inch by following a scribed line, free hand, and by the use of a guide templet.

The patented tool-holder and upset head tool make it possible to cut stainless and other alloy steels, as well as aluminum, brass, and copper. Starting holes can be punched under power, which is an advantage when inside cutting is required. Tools and dies are made of high-speed steel, and can be resharpened numerous times. There is a removable material-support plate extending the full depth of the throat. A new machine added to the line has a capacity of 5/16 inch in mild steel. Sheets 24 inches wide and of any length are handled on this particular machine through the use of the revolving head feature, which permits cutting at any angle on a 360-degree circle.



Nibbling Machine with a Capacity for Cutting Mild Steel 5/16 Inch Thick

Polishing and Buffing Lathe Made by Divine Brothers Co.

Other nibbling machines built by the company have cutting capacities in mild steel up to 7/8 inch, and throat depths of 9, 12, 18, 30, 34, and 36 inches. They are used for many operations, such as cutting templets, duplicating parts, and cutting out bulkhead fittings, links, cams, flanges, stripper plates, clamp supports, instrument panels, tank baffles, metal fuselage parts, etc. 59

Divine Polishing and Buffing Lathes

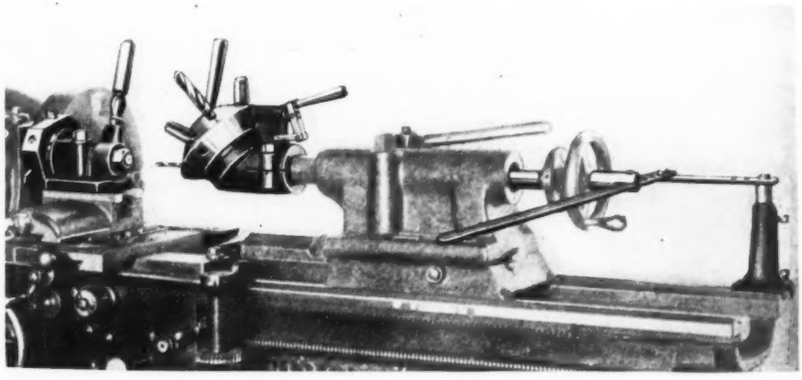
A polishing and buffing lathe of simple construction, designed to have as few moving parts as possible, has been brought out by Divine Brothers Co., Utica, N. Y., in 3-, 5-, and 7 1/2-H.P. sizes. The machine has a V-belt drive to the spindle, which runs in two self-aligning ball bearings. The spindle is made exceptionally large to prevent "whipping" under pressure from the V-belts. Bronze spindle units are used to prevent wear on the spindle threads, as it is much cheaper to replace a nut than to replace the spindle.

A positive plunger type spindle lock is provided for holding the spindle stationary while changing wheels. The number and size of V-belts used to drive the spindle are carefully selected to insure safe transmission of power at the full rated capacity of the lathe. The V-belts can be changed or replaced quickly by simply loosening a few bolts and slipping the belts into place. The base castings are designed with an overhang for the spindle to facilitate handling bulky work or to accommodate automatic work-holders. 60

Jefferson Turret and Pull-Feed Attachments for Lathes

The Jefferson Machine Tool Co., Fourth, Cutter, and Sweeney Sts., Cincinnati, Ohio, is now manufacturing three attachments that can be applied to any standard engine lathe, as shown in the illustration, to adapt it for turret lathe operations, such as forming, roughing, boring, finishing, knurling, drilling, tapping, etc., without stopping the lathe or shifting belts. The devices illustrated comprise a tailstock turret, a toolpost turret, and an adjustable pull-feed, all of which can be easily attached to any size lathe.

The tailstock turret accommodates five separate tools, and can be quickly attached to the spindle. The tool-



Lathe Equipped with Jefferson Tailstock and Toolpost Turrets, and Pull-feed Attachment

To obtain additional information on equipment described on this page, see lower part of page 148.

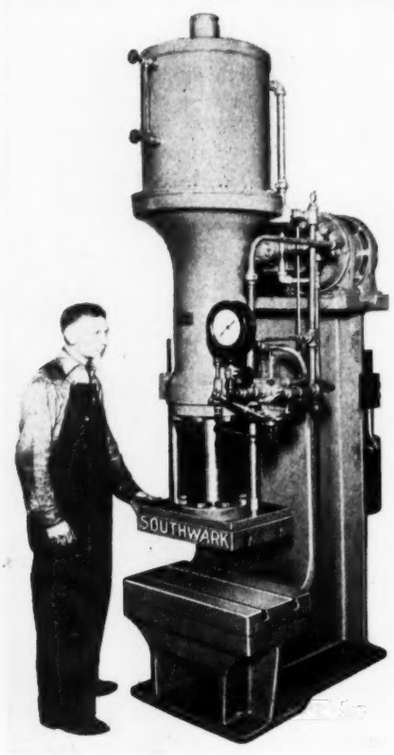
post turret has provision for carrying four separate tools instead of one, as in the ordinary toolpost. The adjustable pull-feed gives exceptionally easy control over the movement of the tailstock itself, the lever handle being quicker and easier to operate than a crank-handle. 61

Baldwin Southwark Multi-Purpose Presses

Two new presses for general-utility work are being built by the Baldwin Southwark Division of the Baldwin Locomotive Works, Philadelphia, Pa. These self-contained units have control features previously found only in larger and more expensive presses. Designed for a wide range of work, a single control, either hand- or foot-operated, permits the operator to inch, stop, or reverse the platen of the press at any point in its stroke. This feature is useful in performing assembling or straightening operations.

Another setting of the control adapts the press for semi-automatic operation. With this setting, there is a rapid approach movement until the work is met, after which a predetermined pressure is built up, followed by automatic reversal. This operating feature is especially valuable in die work. If preferred, the platen can be automatically reversed when it reaches a given position.

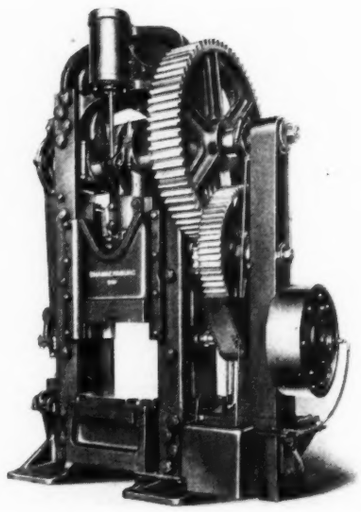
The standard presses are built in 65- and 80-ton capacities. While the control is similar in operation to that used on the Baldwin Southwark larger "Hyspeed" presses, its construction has been simplified to effect a considerable saving in manufacturing costs on the smaller units and thus bring them within the low-price field. 62



Baldwin Southwark Multi-purpose Press

Chambersburg Double-Geared Trimming Press

The Chambersburg Engineering Co., Chambersburg, Pa., is now building a line of double-geared steel side trimming presses in capacities up to 1000 tons. The presses of 150 tons and over are equipped with an improved type pneumatically operated clutch, as shown in the illustration. All presses in this line are of the patented forged-steel, side-frame construction. The regular features include over-size crank, outboard bearings for all shafts, reinforced pitman, extra large pitman pin, and gears cut from solid steel. 63



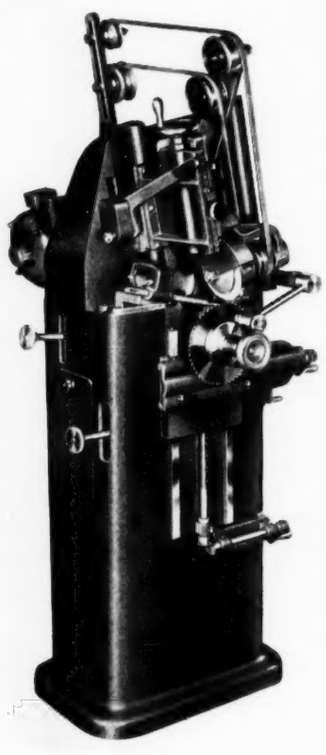
Chambersburg Trimming Press Built in Capacities up to 1000 Tons

Covel-Hanchett Precision Saw-Sharpening Machine

The Covel-Hanchett Co., Big Rapids, Mich., is placing on the market a new No. 11-30 precision machine for sharpening metal-cutting saws. This machine is designed to simplify the task of sharpening the high-efficiency saw blades now coming into wide use through the introduction of hydraulically operated cold metal-sawing machines and other improved metal-sawing equipment. The teeth on saws of this kind must be ground very accurately in order to operate efficiently at the high rates of speed for which they are designed.

The tooth forms of these saws are different from those ordinarily used for cold-sawing. This special tooth shape imparts a rolling action to the chip. It is automatically ground to shape through the use of cams mounted inside the base of the machine. The saw in which this form of tooth is used has alternate high and low teeth to provide better distribution of the load between the teeth. The grinding of the high and low teeth is accomplished automatically. The high teeth are beveled on each side to insure the proper cutting action, the grinding of the bevels on the sides of the teeth also being performed automatically.

This new saw-sharpening machine is also available equipped with an attachment for grinding hacksaws having teeth of the new high efficiency type. 64



Automatic Saw-sharpening Machine

To obtain additional information on equipment described on this page, see lower part of page 148.

Vertical Type Injection Molding Press

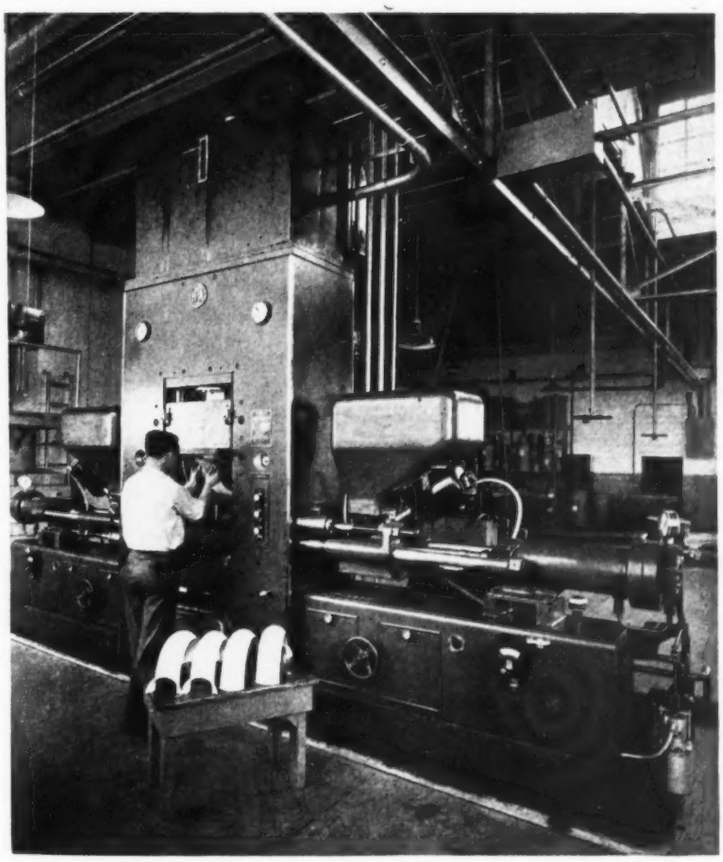
The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has recently installed an 18-ounce vertical type injection molding press in the plant of the Metal Specialty Co., Plastic Division, Richmond, Ind. This H-P-M Model 250-V-double-9 machine incorporates two complete injection units, one on each side of the vertical downward-acting clamp press. The movements of these units are hydraulically synchronized with those of the press. Each unit has a capacity of 9 ounces of material per shot, or a total of 18 ounces per cycle. The vertical clamp press, as well as the two injection units, is individually operated, each having its own radial pump power unit.

Directly applied hydraulic power is employed for all pressure actions. Torque motor-driven feed mechanisms automatically proportion and deliver the granular molding material to the injection chambers. A circulating fluid, heated electrically by immersion elements, transfers the heat to the material in the chambers. Positive connection between the chamber nozzle outlets and the mold inlets is provided by direct hydraulic means. No mechanical adjustments are required.

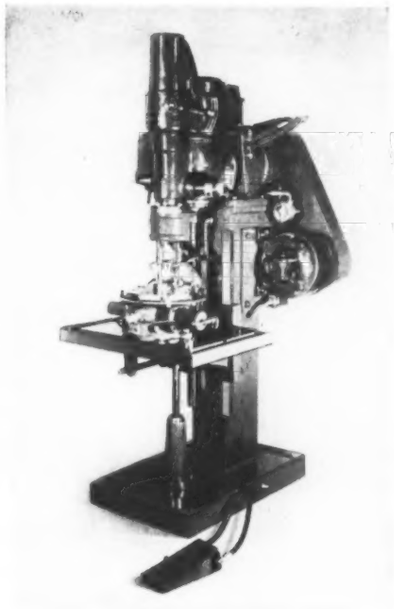
The nozzles automatically withdraw slightly at the end of each cycle, thus breaking the sprues. A wide separation of the members can be obtained quickly to provide access to the nozzles. A straight-line hydraulic clamp is used for clamping the molds. The radial pump that generates the pressure for the clamping unit provides a constant pressure against the clamp ram. An automatic control regulates this pressure according to the demand, maintaining the output near zero when the ram is stationary, while holding the full pressure on the molds.

The vertical clamp pressure is 250 tons; the maximum mold size, 24 by 24 inches; the minimum shut height of the mold, 14 inches; the maximum opening between plates, 29 inches; the maximum stroke of the mold-carrier platen, 15 inches; and the pressure per square inch on the material in the injection chamber, 20,000 pounds.

The machine operates at a speed of from 3 to 5 complete cycles per minute. 65



Vertical Molding Press with Two Complete Injection Units Made by the Hydraulic Press Mfg. Co.



Kaufman "Hi-Duty" Tapping Machine with Indexing Dial

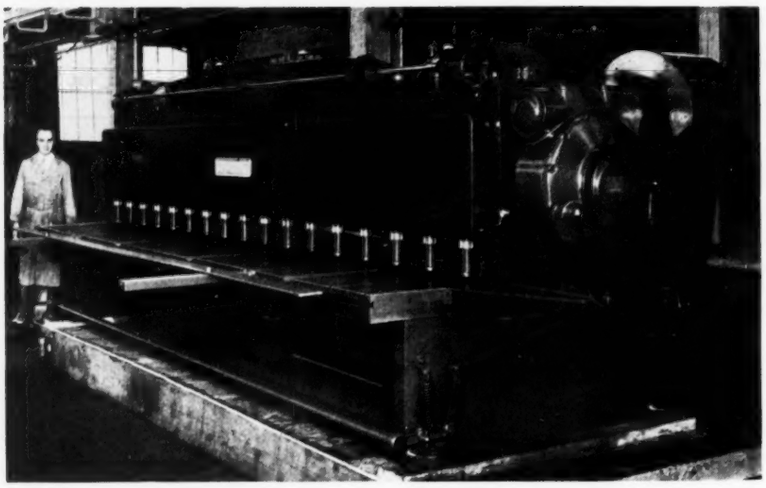
Kaufman "Hi-Duty" Tapping Machine

A No. 5-A "Hi-Duty" tapping machine, which is equipped with a No. 40 indexing, eight-station, ejecting style dial, arranged to hold circular pieces for tapping, has just been brought out by the L. J. Kaufman Mfg. Co., Manitowoc, Wis. The chucking jaws or the complete dial can be changed to accommodate a variety of similar pieces. High production can be obtained in this way with the standard tapping machine by adding a two-spindle multiple head and the indexing equipment.

Two pieces are tapped at each stroke of the spindle, the finished parts being ejected automatically. All operations are interlocked to prevent damage to the machine or work. The indexing stations and the index-pin must be in their proper positions in order to permit the tapping spindle to begin its downward stroke.

Work-dials to accommodate eight, twelve, and sixteen stations can be furnished, their lay-out depending upon the material being tapped and the speed at which the taps can be operated. All operating movements are actuated by air pressure, including the indexing, locking, and clamping. Being entirely air-controlled, the machine permits very sensitive tapping with taps of all sizes within the capacity of the machine. Much second-operation work can be handled, thus taking the load off the screw machines. Dies can also be used for external threading. 66

To obtain additional information on equipment described on this page, see lower part of page 148.



Cincinnati All-steel Shear Capable of Taking a 16-foot Cut in 3/8-inch Plate

Cincinnati All-Steel Shear

The Cincinnati Shaper Co., Hopple, Garrard, and Elam, Cincinnati, Ohio, has recently added to its line of heavy plate shears a new size which has a cutting length capacity of 16 feet in plate material 3/8 inch thick. The basic design of this machine is the same as that of the Cincinnati all-steel shear described in October, 1939, MACHINERY, page 119, the main difference being in the capacity. The front-controlled, power back gage, front gage, slitting gage, and light-beam gage shown on the new machine illustrated are furnished as extra equipment. 67

Federal Automatic Hoop Forming and Welding Machine

The Federal Machine & Welder Co., Warren, Ohio, has brought out an automatic welding machine designed to produce wire hoops for kegs and other shipping containers. This machine performs in one continuous operation work that previously required several operations. It takes the wire from a supply reel at a uniform speed of approximately 150 to 175 feet per minute. The wire is drawn through two-plane, quick-release, straightening rolls by a double set of spring-loaded drive rolls. The straightening equipment is mounted on a floating carriage.

After having passed through the straightening rolls, the wire is run through three adjustable forming rolls and into a sizing ring, where it is formed into a hoop of the required diameter. After the hoop has been formed, it is sheared to the exact circumferential length, welded, and automatically ejected on a stacking fixture, a limit switch arrangement being set to count the required number of hoops. In this case, the stacking fixture receives 250 hoops, when it is automatically tripped and a new stack begins to pile up.

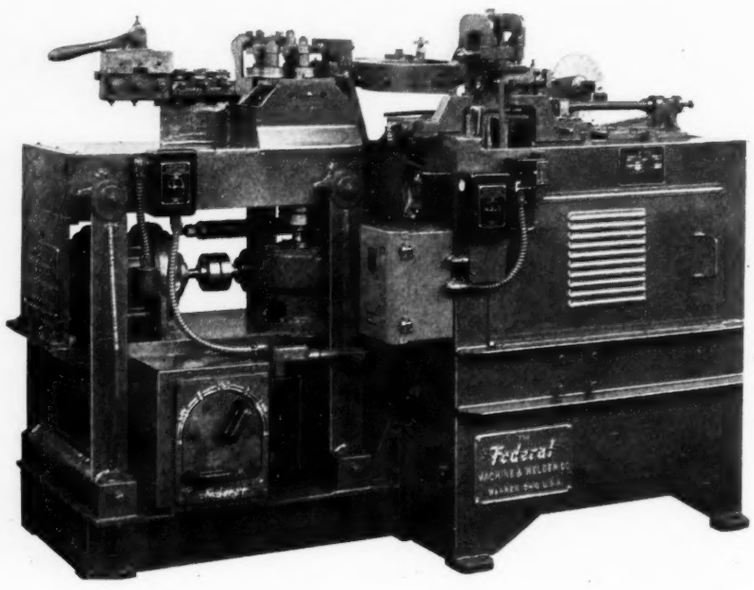
This particular machine was arranged to weld rings of 10- or 11-gage wire, 14 to 15 1/2 inches in diameter. The diameter of these rings is held to a tolerance of 0.005 inch. After being ejected from the machine, the rings are flat within 1/16 inch. This machine has a production capacity of 1500 to 1800 hoops per hour. The only attention required is to load the coil of wire in the reel and remove the stacks from the fixture.

Although developed for rings of certain sizes, the same arrangement can be used for rings made in almost any size of wire and in any diameter. 68

Transparent Medium that Serves as Tracing Cloth

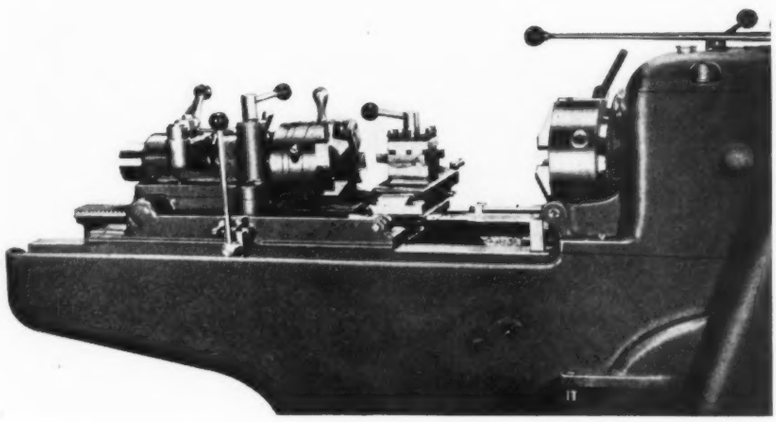
A new transparent medium, known as P.T.M., that is neither a tracing cloth nor vellum, but that permits blueprints such as obtained from ink tracing to be obtained at pencil drawing speed, has been placed on the market by the Frederick Post Co., P.O. Box 803, Chicago, Ill.

Blueprints made from drawings produced with ordinary hard drawing pencils on this new medium have a solid background and sharp, white lines. On black-lined prints, the detail is solid and sharp and the background uniformly white. This new material is claimed to have from two to ten times the tensile strength of vellum when wet, and from 10 to 50 per cent greater tear strength. The reverse side is dust-protected by an ice-glazed finish. It is available in 20-yard rolls in widths of 30, 36, 42 and 54 inches. 69



Federal Automatic Machine Having Capacity for Forming and Welding 1800 Hoops an Hour

To obtain additional information on equipment described on this page, see lower part of page 148.



Landmaco Threading Machine Equipped for Reconditioning and Threading "Drill Steels"

Landmaco Equipped for Threading Rock Bit Steel

The flexibility of the Landmaco threading machine made by the Landis Machine Co., Inc., Waynesboro, Pa., is indicated by the accompanying illustration, which shows one of these machines arranged especially for reconditioning and threading "drill steels" or rods. The spindle of this machine is equipped with a three-jaw universal chuck instead of the conventional Lanco revolving type head. The die-head is mounted on a special carriage.

The carriage is equipped with a tailstock into which is fitted the shank of a Landmatic head. This shank is of extra long design, and is made a sliding fit within the bore of the tailstock to permit linear travel of the head. A lever is provided to extend the die-head to its most advanced position in the tailstock, where it is rigidly clamped in position for the thread-cutting operations. The machine is of the lead-screw type, and all thread-cutting operations are performed by the use of the lead-screw to insure accurate lead control for the thread.

Directly in front of the die-head, and located on the carriage, is a cross-slide that supports a square turret, which, in turn, can be fitted with turning, facing, forming, and cutting-off tools. The turret can be turned easily to any desired position by unlocking the center-post clamping lever. Unlocking this lever automatically raises the turret, freeing it from the positioning stud so that it can be turned to the desired position by hand. A quick-acting clamp is provided on the side of the carriage for locking the entire assembly during cutting-off operations.

Since the Landmatic head is of the pull-off type, a stop is provided for stopping the forward movement of the carriage. This stop is adjustable, and can be readily synchronized with the lead-screw tripping mechanism, so that both actions will take place simultaneously. This assures the production of threads of uniform length and also permits threading close to a shoulder. 70

Measuring Wires for Internal Gears

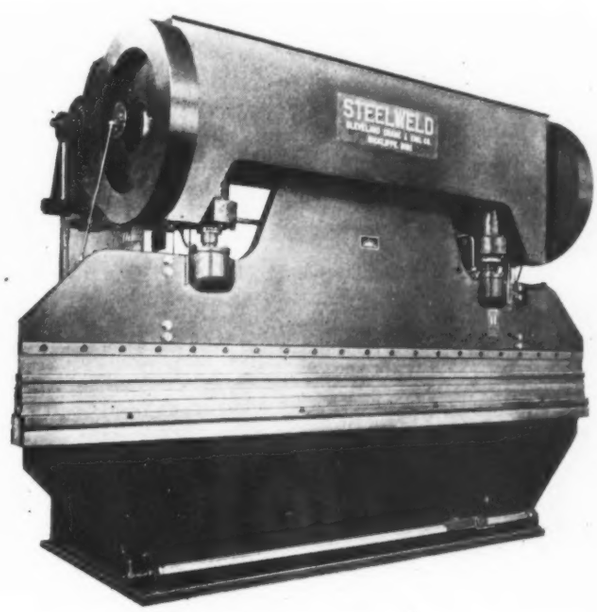
The Van Keuren Co., 176 Waltham St., Watertown, Mass., has placed on the market a new set of measuring wires, designated No. 261N, for checking internal spur gears. This series of wires is based on sizes determined by dividing 1.44 by the diametral pitch. This gives a maximum number of sizes that are exact, in even thousandths of an inch, and also provides some sizes that are the same as those for the external gear series, which are determined by dividing 1.728 by the diametral pitch.

A complete set of tables giving the measurements between the wires for gears having even and odd numbers of teeth ranging from 10 to 171, and for measuring angles of 14 1/2, 20, and 30 degrees is available. 71

Steelweld Bending Presses with Bed and Ram Extensions

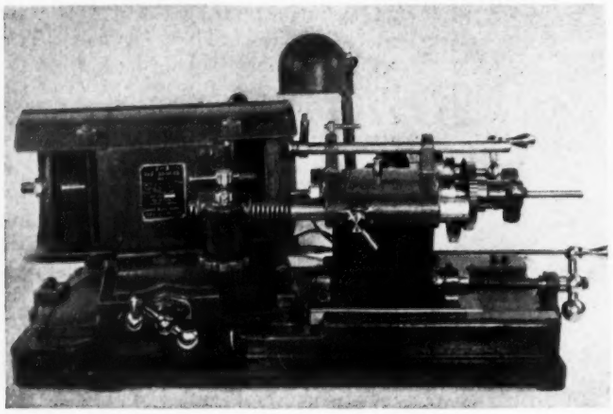
The Steelweld Machinery Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio, has developed a series of Steelweld bending presses for forming, bending, blanking, drawing, and multiple-punching operations, with extensions of bed and ram at one or both ends. The Model H-8 machine illustrated is provided with 2-foot extensions at each end. This press normally handles plates 8 feet long by 5/16 inch thick between housings, but the extensions make possible the forming of plates 14 feet in length and up to No. 12 gage in thickness.

Other Steelweld presses in this series will handle plates up to 20 feet long and 3/4 inch thick. The frames

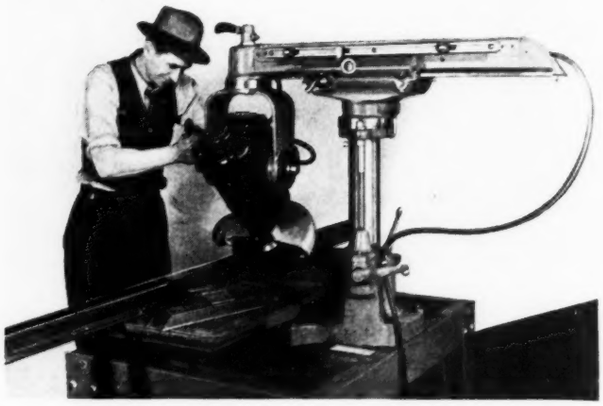


Steelweld Bending Press Provided with 2-foot Extensions at Each End of Bed and Ram

To obtain additional information on equipment described on this page, see lower part of page 148.



J-B Tap Grinder Placed on the Market by the Edward Blake Co.



Radial Cutting Machine Equipped for Cutting Formed Sheet Iron

of these machines are of one-piece all-welded construction. All gearing is protected by metal covers, and the shafting and machinery are located at the rear of the machine to lessen the danger of damage from bent-up plates, crane hooks, etc.

Two solid forged-steel eccentrics, one at each end of the machine, operate the ram. Each eccentric has three extra-large main bearings and an eccentric bearing. The bearings are automatically lubricated by pressure type oiling units. The main-drive clutch is of the heavy multiple-disk type, easily adjusted without tools. The braking clutch is a duplicate of the main clutch. 72

These machines consist primarily of a motor-head unit and a work-head unit mounted on a base. The work-head is mounted on a slide with a screw feed that permits it to be easily adjusted to suit various tap lengths. The work-head unit rocks on a shaft in the baseplate slide, and is connected by an adjustable eccentric mechanism with the crankshaft spindle. The desired relief is obtained by a simple screw adjustment of the eccentric mechanism. A graduation mark indicates the exact position in which the eccentric should be locked. To grind taps with a different number of flutes, it is necessary to remove and change only one gear. 73

ripping, and mitering at both simple and compound angles. The machine can also be used for either wet or dry cutting. 74

Federal Dial-Feed Press

The Federal Press Co., Elkhart, Ind., has recently placed on the market a dial-feed press designed to operate at exceptionally high production speeds and to handle difficult drawing operations. This press will perform high-speed marking, mass riveting, pressing, forming, punching, and drawing operations.

A special auxiliary safety stop prevents damage to dies in case of a

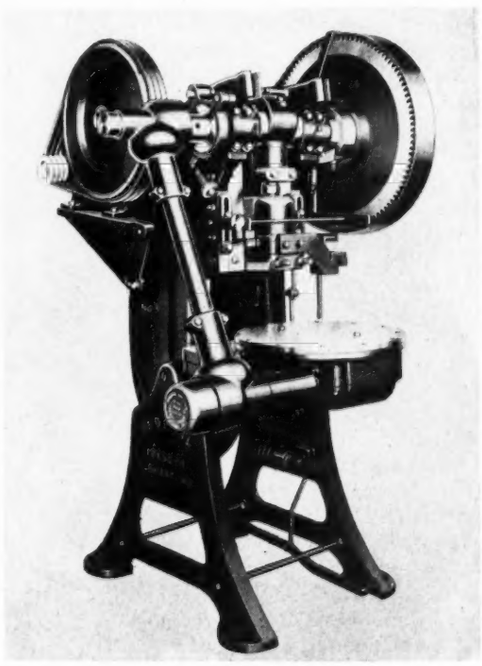
J-B Tap Grinder

A small, self-contained machine, complete with motor, diamond-truing device, extension cord, and positive mechanical controls that enable it to grind uniform relief on the chamfer of each land on two-, three-, four-, and five-flute taps has been brought out by the Edward Blake Co., 53 Marshall St., Newton Centre, Mass. This machine will sharpen right- or left-hand taps and will grind any taper or angle of chamfer desired. The amount of relief can be accurately set and quickly changed. The machine will sharpen taps of any length held on the outside diameter of the thread in sizes from No. 0 to 1/2 inch, inclusive. Taps of any length in sizes from No. 0 to 3/4 inch, inclusive, can be held on shanks. Taps up to 5 inches in length in sizes from No. 0 to 2 inches can be held on centers. The hollow spindle accommodates long shank, nut, or tapper taps. A stop in the spindle permits grinding taps to uniform length.

Walker-TurnerRadial Cutting Machine

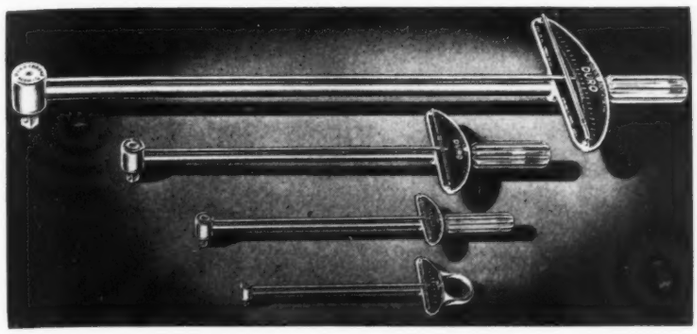
A new radial cutting machine adapted for a wide variety of cutting operations on metal, wood, and plastic materials has been brought out by the Walker-Turner Co., Inc., 501 South St., Plainfield, N. J. This machine has a patented shock-proof geared motor, mounted in a double yoke. With this design, the saw-shaft can be brought close to the work, so that small blades can be used, thus obtaining greater rim or cutting force.

The sliding ram gives the operator an unobstructed view of the work, and the double yoke in which the motor is suspended makes it possible to use the machine for both right- and left-hand cross-cutting,

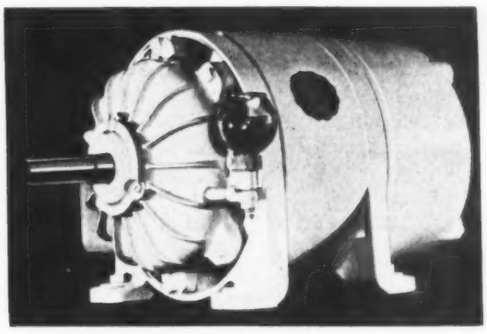


Federal Dial-feed Press Designed for High-speed Operation

To obtain additional information on equipment described on this page, see lower part of page 148.



Tension-measuring Wrenches Made by Duro Metal Products Co.



Oil-lubricated Ball-bearing Motor Made by U. S. Electrical Motors, Inc.

jam. The design of the press permits an exceptionally wide range of tooling. The indexing system is built into the standard Federal chassis, the design of the actuating cams insuring a smooth, positive, indexing and locking action. When equipped with a Federal automatic loading and ejecting mechanism, a production of from 9000 to 10,000 units per hour can be obtained with this press. It can be furnished either with or without the automatic loading and ejecting feature, as desired. 75

Duro Tension-Measuring Wrenches

The Duro Metal Products Co., 2649 N. Kildare Ave., Chicago, Ill., has brought out a new tension-measuring wrench having a small, compact head designed for easy access to restricted places. In using this tool, a slide marker is set on an easily read scale to indicate the desired tension, after which the handle is pulled, causing the pointer to travel across the scale until it reaches the marker. At this point, the wrench has exerted the required or predetermined torque

The largest of the four wrenches in this line has a capacity of 3/4 inch, and is intended for use in assembling or servicing Diesel motors, oil and steam lines, tractors, trucks, etc. It is made with a 3/4-inch square drive and registers up to 300 foot-pounds. This wrench is also made in 1/2-, 3/8-, and 1/4-inch sizes.

The 1/2-inch wrench is intended for all work requiring a tightening pressure of 100 foot-pounds. The 3/8-inch size is particularly adapted for servicing aluminum cylinder heads, spark plugs, connecting-rods, airplane struts, wings, etc. It is also useful for refrigeration work. This size registers up to 65 foot-pounds pressure.

The smallest size or 1/4-inch wrench is designed for fine instrument adjustments, generators, starters, and ignition work. It registers up to 120 inch-pounds tension, and can be furnished with 1/4- or 9/32-inch square drive. 76

Oil-Lubricated Explosion-Proof Motor

Explosion-proof electric motors for Class 1, Group D service, and double-enclosed motors, developed by U. S. Electrical Motors, Inc., 80 Thirty-fourth St., Brooklyn, N. Y., are now being equipped with oil-lubricated ball bearings and constant-level oilers. This equipment is furnished on all motors with 3600 R.P.M. ratings, and on all motors with 1800 R.P.M. ratings in sizes larger than 25 H.P. 77

Double-Spindle Threading Machine

A double-spindle threading machine recently developed by the Geometric Tool Co., New Haven, Conn., is being furnished in three sizes covering a complete threading range of from 1/16 inch to 1 1/2 inches in diameter, the National Fine Thread Series being included only in the larger diameters. This machine will cut long threads economically, where the length of the thread is sufficient to allow the operator time to unload and chuck one work-holding fixture while the thread is being cut in work held in the other fixture.

Geometric Double-spindle Threading Machine Built in Three Sizes

This double-spindle machine is built up in units, thus permitting unusual flexibility of operation. For example, the separate units make it possible for a thread of one size to be cut with one unit while a thread of another size is cut with the other unit, each being run at the proper speed and supplied with suitable lubricant from an independent pump, and each having an individual chip pan. A right-hand thread can be cut with one unit while a left-hand thread is being cut with the other. For work where two units are not required, only one unit need be operated.

To obtain additional information on equipment described on this page, see lower part of page 148.

These machines are all designed for precision threading, and have unique adjustment features. Special holders such as used with the new Geometric single-spindle threading machines can also be used. 78

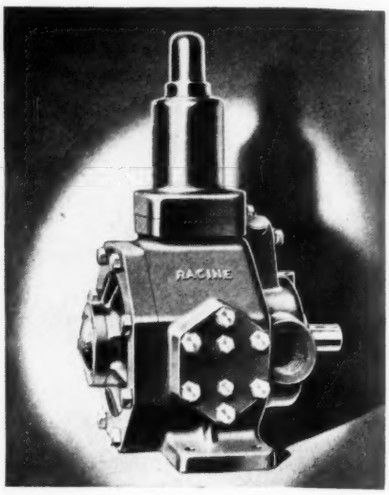
Speed Lathe with Foot-Pedal Control

The Standard Electrical Tool Co., 1948 W. 8th St., Cincinnati, Ohio, has developed a speed lathe for production service on small parts requiring polishing, countersinking, reaming, burring, and filing. This machine is adapted for use in aeronautical, automotive, and industrial plants. The outstanding feature is the clutch and brake arrangement for stopping the work-spindle through foot-pedal control while the motor continues to operate. It is possible to secure a variation of this arrangement which will permit the clutch to be engaged only so long as pressure is applied to the foot-pedal.

These machines are built to run at only one speed, but can be furnished for operation at any speed required, from 150 to 3450 R.P.M. in sizes from 1/2 to 2 H.P. Regular equipment includes a Morse taper socket, but a drill chuck or universal lathe chuck can be supplied. 79

Speed Lathe Built by the Standard Electrical Tool Co.

Garlock Packing of "Lattice-Braid" Construction



Racine Variable-volume Hydraulic Pump of Increased Capacity

"Lattice-Braid" Packing

A new packing for service on shafts of centrifugal and rotary pumps, in which all the braided strands are lattice-linked together, as illustrated, has been brought out by the Garlock Packing Co., Palmyra, N. Y. This packing, known as "Lattice-Braid," is made in sizes from 3/8 to 1 inch, and in various materials such as asbestos yarn and cotton, as well as with wire insertions to suit various operating requirements. It is claimed that the "Lattice-Braid" construction prevents disintegration into loose strands, regardless of wear, and that infrequent adjustment is required because of the flexibility and controlled porosity imparted by the semi-automatic pressure action. 80

Racine Variable-Volume Hydraulic Pump

The Racine Tool & Machine Co., 1752 State St., Racine, Wis., is now building a variable-volume hydraulic pump having a continuous pressure rating of 1000 pounds per square inch, which is twice that of the same type pump previously made by this company. These new model pumps have a wide application in the operation of plastic molding and other types of presses, die-casting, welding, forming, and pressure-testing machines, etc., and for operating chucks and work-clamping devices.

In addition to the variable-volume, constant-pressure feature obtained by a simple type of hydraulic governor, the pumps are also furnished with a manual handwheel for positive control of volume. Another combination consists of a dual pressure control, operated hydraulically or electrically, to obtain maximum volume at low pressure for rapid-traverse movements, and minimum volume for holding a high pressure.

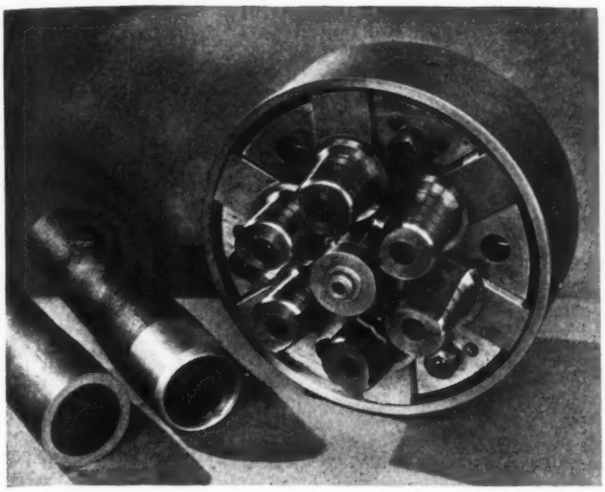
The self-centering feature of this pump is designed to maintain any desired pressure without the use of by-pass or relief valves. This feature is an important factor in saving power and reducing the amount of generated heat. The ability to deliver a large volume at low pressure and to maintain high pressure at deadhead, or minimum delivery, often eliminates the necessity for using two pumps. 81

"Protect-O-Metal" for Preventing Spatter in Electric Welding Operations

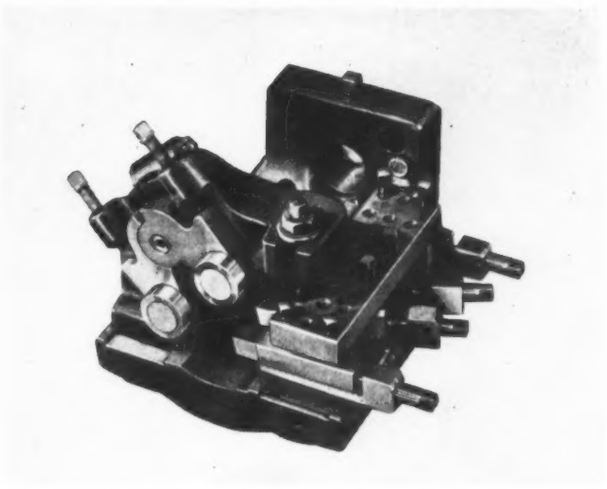
An improved compound known as "Protect-O-Metal No. 2" for use in preventing spatter in electric welding has been developed recently by George W. Smith & Sons, 79 Sperling Ave., Dayton, Ohio. This new material is easily brushed down the seam to be welded and on adjacent surfaces where spatter usually collects. After welding, all spatter is removed by simply wiping off the metallic surfaces, no washing being required.

The advantages claimed for the new material are: No smoke or odor produced during welding; neater, better lying, and stronger welds; and no harmful effect on paint applied after welding. The compound can be thinned for easy application by mixing two gallons of water with one gallon of the compound. 82

To obtain additional information on equipment described on this page, see lower part of page 148.



National Acme Threading and Turning Tool Equipped for Turning, Facing, and Chamfering Tubing



Gisholt Multiple-cutter Turner for Turret Lathes Designed for Heavy High-speed Cuts

"Double-Duty" Threading and Turning Tools

Since its introduction of self-opening die-heads with circular-ground thread chasers, the National Acme Co., 170 E. 131st St., Cleveland, Ohio, has developed a complete line of end turning, end forming, and combination turning and threading cutters of the circular type for use in the company's standard circular-chaser die-heads. These tools are known as "double-duty" heads, because one head can be used for both threading and hollow-milling work.

Typical examples of the hollow-milling work handled by this tool on a production basis include valve stems, formed gasket seats, upset pipe, and a wide class of work having several body diameters, round-nose ends, etc. Tools for reaming, facing, beveling, or chamfering operations can also be inserted in the heads, so that these operations are performed at the same time that the regular forming and turning cuts are being taken.

To change from threading to hollow-milling, or vice versa, requires only a change of holding blocks and cutters. The diameters of both the end cutters and chasers are adjustable. The hollow-mill cutters are of the circular forming tool type, and since they are used in multiple, the advantages of fast speeds, smooth turned diameters, and uniformity of production are obtained, in addition to the double-duty feature. These heads are supplied for both revolving and non-revolving spindle machines, and for standard and special applications, in sizes from 1/4 inch to 13 3/8 inches. 83

Gisholt Multiple-Cutter Turner for Turret Lathes

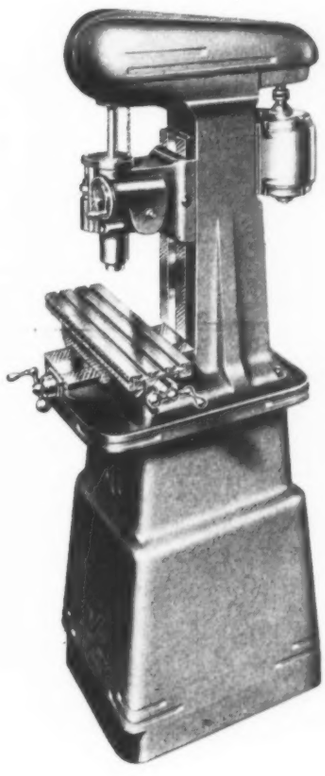
A new multiple-cutter turner for turret lathes brought out by the Gisholt Machine Co., 1209 E. Washington Ave., Madison, Wis., is designed to take several reducing cuts simultaneously. Among the design features of this tool that contribute to its ability to make heavy high-speed cuts and still maintain exact dimensions and fine finish are its rigid steel construction; hardened steel rollers mounted on roller bearings; and adjustable roller arms that are attached securely to the block.

Set-up operations are facilitated by the micrometer adjustment screws on the tool-blocks. All movable parts are adjustable for wear, and are enclosed to exclude chips and dirt. This turner is available in several sizes, with capacities for turning work from 3/4 inch to 4 3/4 inches in diameter. The multiple-cutter turner illustrated will turn work on one to four or more diameters at the same time. Individual or multiple tool-blocks are available. 84

Combination Vertical Milling Machine and Jig Borer

A combination vertical milling machine and jig borer has been developed by the Machinery Mfg. Co., P. O. Box 155, Vernon Branch, Los Angeles, Calif. This new machine is designed to handle jig, fixture, and die work, as well as all types of vertical milling work. It has many applications in machine and automotive shops, and is particularly adapted for drilling and boring operations in machining dies, plastics, and metal patterns. It can be employed for laying out various kinds of work requiring great accuracy, and can be equipped with dial indicators and measuring plugs for lay-out work. Duplicating work can be performed by employing a profile attachment.

The quill is so arranged that a slow hand-feed is provided by a handwheel, accurately graduated to 0.001 inch, or the slow traverse can



Combination Milling Machine and Jig Borer

To obtain additional information on equipment described on this page, see lower part of page 148.

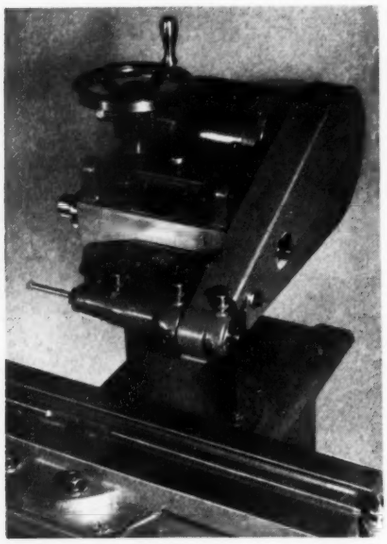


Fig. 1. Internal Grinding Attachment Made by Brown & Sharpe

be quickly disengaged and a rapid one engaged by merely turning a knurled knob. This rapid 1 to 1 ratio traverse enables drilling, die cavity milling, and similar operations to be performed with greater rapidity.

The collet capacity is 1/2 inch. Eight spindle speeds ranging from 250 to 4200 R.P.M. are available. The table is 6 inches by 21 inches. The longitudinal table travel is 12 inches; the cross table travel, 6 inches; and the maximum distance from the table top to the spindle end, 10 1/2 inches. The sliding head has a movement of 10 1/2 inches, and the feed dials are graduated to 0.001 inch. The distance from the center of the spindle to the column ways is 6 inches, the saddle length 11 inches, and the quill travel 3 inches. The floor model requires a floor space of 38 by 33 inches, and weighs 700 pounds without the motor. It requires a driving motor of 1/2 H.P., having a speed of 1750 R.P.M. 85

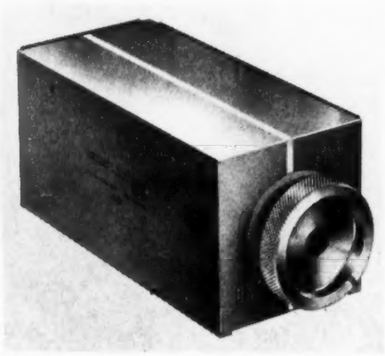


Fig. 2. Brown & Sharpe Toolmaker's Magnetic Block

Brown & Sharpe New Tool-Room Equipment

The Brown & Sharpe Mfg. Co., Providence, R. I., has recently developed an internal grinding attachment for use on its No. 10 cutter- and tool-grinding machine. When used in conjunction with the revolving-spindle headstock, this internal grinding attachment permits precision-grinding of holes up to 2 1/2 inches in length and 1/2 inch minimum diameter in work requiring a maximum swing of 6 3/4 inches. The spindle of this attachment runs at a speed of 22,500 R.P.M., and takes wheels 1/2 inch in diameter by 1/4 inch thick, with a 3/32-inch hole.

A long, adjustable, phosphor-bronze bearing supports the spindle at the wheel end, and two double-row, self-aligning ball bearings at the pulley end take the pull of the belt. All bearings are adequately lubricated and are protected from dust and grit.

The attachment is bolted to the machine column. The drive is by fabric belt from a pulley mounted on the motor shaft. The belt and pulleys are covered by a guard. The attachment includes a height gage for setting the spindle at the exact center height. The attachment weighs approximately 15 pounds.

A No. 760 toolmaker's magnetic block is another recently developed product of the company. This magnetic block is offered for sale only in the United States and its Territories. It is of the permanent magnet type, and can be used advantageously for many jobs that ordinarily require special, cumbersome clamping arrangements. The convenient size, 2 1/2 by 2 1/2 by 5 1/2 inches, makes this block especially adapted for toolmaking, inspecting, and many manufacturing jobs. Iron or steel work of sufficient width to span the narrow insert in the top face of the block can be held firmly. The block can be used for holding work for either wet or dry grinding.

When the knurled control wheel at one end of the block is turned to the "on" position, the work is held firmly on the block, and if the block rests on a conductive surface, it is also held firmly to the latter member. The work and block are both released when the control wheel is turned to the "off" position. The holding power can be regulated by adjusting the control wheel so that the work can be removed without taking the block from the conductive surface. The magnetic pull on the end of the block enables it to be used in an upright position on a conductive surface. ... 86

Electric Sanding Machine Made by the Detroit Surfacing Machine Co.

Portable Electric Sanding Machine

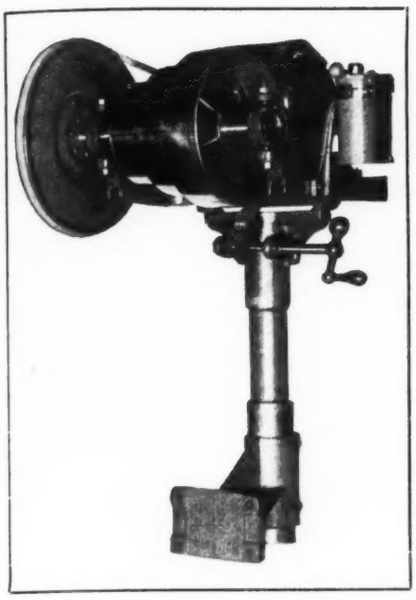
A new portable, all-electric, sanding machine designed for extreme flexibility in replacing slow and expensive hand sanding or rubbing operations on flat, curved, or irregular surfaces has been placed on the market by the Detroit Surfacing Machine Co., 7433 W. Davison Ave., Detroit, Mich. This sander, known as the "Easy," is adaptable to practically every production or maintenance application in smoothing or finishing whitewood, metal, Bakelite, plastics, or composition material. It is also adapted for sanding or rubbing primer surfacer or sealer coats, shellac, varnish, lacquer, enamel, and other finishes. 87

Ball-Bearing Motor Drives

A new line of ball-bearing equipped "Modern" individual motor drives has been brought out by the Quality Hardware & Machine Co., 5853 N. Ravenswood Ave., Chicago, Ill. This new series includes fifteen models for shapers, milling machines, and all types of lathes, including turret lathes. The "Modern" motor drive is applicable to any belt-driven machine, and is designed primarily for converting lineshaft drives on cone-pulley machines to individual motor drives. The drive is a complete, self-contained unit, including a motor mounting that can be easily attached to the machine by means of four bolts.

The motor drive to the countershaft, which runs in two ball bear-

To obtain additional information on equipment described on this page, see lower part of page 148.



Motor Drive Brought out by the Quality Hardware & Machine Co.

ings, is by V-belt, the final drive being obtained by means of a standard flat belt. A crank and screw control that actuates a cam working directly against the base of the motor and drive-shaft mounting provides a wide range of adjustment for the belt tension. The fast and positive action of this adjustment facilitates keeping the belts under the proper tension, and provides means for loosening the tension to permit shifting the belts. The drive control is hand-operated, although the units can be equipped for electric controllers. In addition to the column type mounting shown in the illustration, for use on lathes, shapers, and similar machine tools, there is a new series of ball-bearing drives designed for mounting on punch presses, power hacksaws, drill presses, and similar machines. 88

Tantung Brazed- and Welded-Tip Tools

The Fansteel Metallurgical Corporation, North Chicago, Ill., has just placed on the market a new material for cutting tools known as "Tantung." This new product was developed to incorporate the desirable steel cutting properties of tantalum carbide in a relatively low-priced cast alloy. Its primary purpose is to fill the gap between high-speed steel and cemented carbides in steel-cutting applications. Tantung is characterized by a red hardness which closely approaches its melting point and by a remarkable resistance to "cratering" or chip wear when cutting steel or other materials on which a continuous chip is produced.

Tantung can be obtained in the following forms: Castings; bars, slabs, or wear strips ground on all sides ready for brazing; welding rod; centerless grinder rests for any type machine, faced with Tantung wearing edge; tips for cutting tools to be applied by brazing; brazed-tip cutting tools for cutting steel; and welded-tip tools for cutting steel. Tools made from this material are capable of heavy roughing or intermittent cuts and will withstand considerable rough treatment. 89

Hardinge Collet Indexing Fixtures

Hardinge Brothers, Inc., Elmira, N. Y., is placing on the market three new collet indexing fixtures. Fig. 1 shows a horizontal collet indexing fixture with lever collet-closer; Fig. 2, a vertical type collet indexing fixture with lever collet-closer; and Fig. 3, a combination horizontal and vertical fixture. These fixtures were developed to extend to production work the advantages of the Hardinge indexing fixture for tool-room use. These three new fixtures are designed to meet any positioning requirements. They all take the same 5C Hardinge 1-inch capacity collet. The round-hole collets range from 1/64 to 1 inch capacity. Hexagonal and square types are also available.

In the fixture shown in Fig. 1, the desired collet grip is obtained instantly, and a self-locking feature assures the same tension for all parts produced on a production basis. The index-plate has twenty-four holes. The height of the fixture is 10 3/4 inches, the length 6 1/2 inches, and the width 3 3/4 inches. The base has 1/2-inch wide removable keys for locating the fixture on the sub-base or machine table. Stepped keys can be employed on machines having larger T-slots.

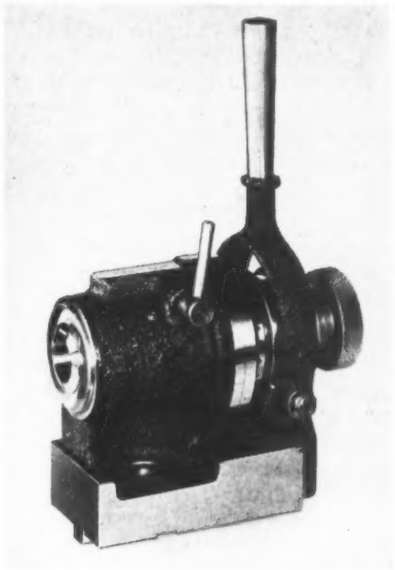


Fig. 1. Hardinge Horizontal Lever-actuated Collet Indexing Fixture

The vertical fixture, Fig. 2, is also arranged with the lever collet-closer for rapid-production work, and is similar in design, operation, and capacity to the horizontal fixture shown in Fig. 1. It has a height of 6 inches, a width of 9 1/2 inches, and a length of 8 1/8 inches. The spindle-positioning lever drops out of the way after indexing.

The combination horizontal and vertical collet indexing fixture, Fig. 3, has the features of both the horizontal and vertical fixtures incorporated in one unit. The production type index-plate eliminates the necessity for reading the graduated dial for each indexing. The spindle has a lever indexing arrangement which operates the same as the one with

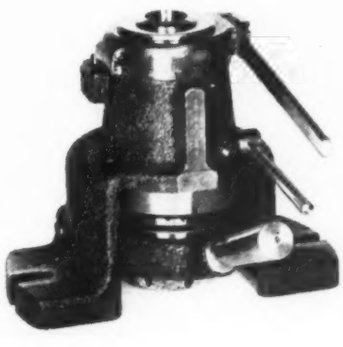


Fig. 2. Vertical Type Indexing Fixture Similar to One Shown in Fig. 1

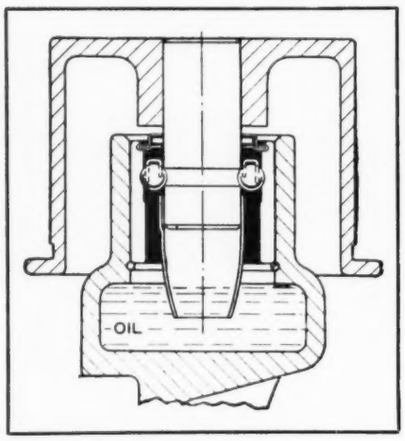
Fig. 3. Combination Horizontal and Vertical Collet Indexing Fixture

To obtain additional information on equipment described on this page, see lower part of page 148.

the vertical collet indexing fixture. The dimensions of this fixture are 6 inches high, 9 1/2 inches wide, and 8 inches long, when used in the vertical position. 90

Ball-Bearing Oil Circulating System

A vertical tension pulley bearing —the TP-13-500—which has been under development and test by the New Departure Division of General Motors Corporation, Bristol, Conn., for a considerable period of time is now being used in some of the latest textile machines. The bearing has a vertical stub shaft on which the pulley is mounted, and contains its own oil circulating system for speeds of



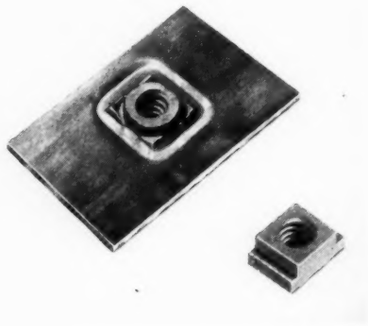
New Departure Ball Bearing with New Oiling System

3500 to 15,000 R.P.M. By this system, oil is drawn from a reservoir below the bearing and is passed in a fine spray directly to the balls and races. Since the bearing is of the self-sealing type with all-metal seals, the oil system is completely enclosed and oil need be added only at yearly intervals.

A feature of this bearing is the extreme ease with which it can be rotated, there being no drag in the seals or heavy lubrication to offer resistance to turning. No lock-nuts, screws, or other parts are required in mounting the bearing, and it can be removed instantly without tools for replenishing the oil reservoir. 91

Nuts Designed to Increase Thread Area in Sheet Metal

"Fast-On" lock-nuts, such as illustrated, have been developed by the FabriSteel Products, Inc., Kerr Ma-



"Fast-On" Lock-nut Applied to Sheet Metal to Increase Thread Area

chinery Bldg., Detroit, Mich., to provide a new method of increasing the thread area in sheet metal. These nuts make it possible to use lighter gage metals and to simplify assembling operations in inaccessible places.

The small square portion of the nut is inserted in a square hole previously cut in the metal, protruding just enough to permit the four corners to be clinched or positively locked to the sheet metal by means of a swaging tool. Thirty-three different kinds of "Fast-On" lock-nuts are available in No. 6, 8, 10, 12, 1/4-inch, 5/16-, and 3/8-inch sizes, with various thread pitch diameters. 92

Portable Pressure Oil Flusher and Dispenser

A portable pressure oil flusher and dispenser for use in flushing out and oiling machinery and other processing or industrial equipment is being

"Port-O-Flush" Bearing Flushing and Oiling Device

placed on the market by J. A. Honegger, 223 Spruce St., Bloomfield, N. J. This equipment, designated the "Port-O-Flush," is designed to instantly and thoroughly flush and oil the bearings of a machine by introducing the oil into the bearing by means of air or gas under a pressure of 60 to 100 pounds per square inch.

The "Port-O-Flush" will handle oils of all viscosities, from kerosene, for flushing out bearings and transmissions of all kinds prior to oiling, up to 600 W. transmission oil for gear reduction drives. It holds one quart of oil, and is so light that it can be carried in one hand. 93

Lufkin Inside Micrometers

The Lufkin Rule Co., Saginaw, Mich., has just placed on the market

Inside Micrometer Set Made by the Lufkin Rule Co.

a line of inside micrometers designated the No. 80 series. These micrometers are substantially lower in price than the No. 680 series, and are designed for use where some of the features in the latter line are not required.

The measuring range of the No. 80 inside micrometers is obtained by the use of extension rods and collars. The No. 80 set has six rods and a 1/2-inch collar, and covers a range of from 2 to 8 inches, while the No. 80-B set has ten rods and a 1/2-inch collar, and covers a range of 2 to 12 inches. The screw thread adjustment of each set has a range of 1/2 inch.

Provision is made for adjusting the tension and taking up wear on the screw thread. The contact points of the rods are adjustable for maintaining their individual lengths, and all contact points are hardened and ground. Both sets can be furnished with a handle and supplied with a plush-lined case. 94

To obtain additional information on equipment described on this page, see lower part of page 148.

Ajax Forged-Steel Flexible Couplings

Two new forged-steel flexible couplings with maximum bore diameters of 1 1/8 and 1 5/8 inches have been added to the line of the Ajax Flexible Coupling Co., Westfield, N. Y. These couplings provide the strength required for heavy-duty service, with a high factor of safety. They are especially designed to meet the present trend toward the use of alloy-steel shafts having a high torque capacity.

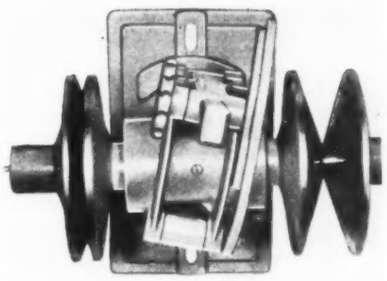
These two new sizes of couplings are constructed on the same principle as the larger Ajax couplings. Rubber bushings and graphite, bronze bearings provide flexibility, positive drive, and free end float, and eliminate noise, backlash, and lubrication problems. 95

Ajax Flexible Coupling of Forged-steel Construction

Columbia Vari-Speed Control of Improved Design

The Columbia Vari-Speed Co., Liberty Bldg., Wheaton, Ill., has recently improved its JFS-Jr. Vari-Speed control through the application of long bronze bushings for the center pulley halves that slide on the rotating shaft. The bearings of these pulleys are lubricated by an Alemite fitting which forces the lubricant through the hollow shaft. These changes in design make possible the complete renewal of the drive members that are subject to wear by simply inserting new bushings.

The position of the new universal base of the speed control can be changed to suit the requirements of the driving and driven pulleys. It is mounted on a sub-base which is located at right angles to the rotating shaft instead of at an angle, as in previous models. This facilitates the mounting of the improved controls without sacrificing the flexibility of the original design. The improvements described have been incorporated in the first three sizes, designated the Nos. 3.5, 4.5, and 6 controls. 96



New Speed Control Brought out by the Columbia Vari-Speed Co.

Trico Unbreakable Wick-Feed Oilers

A new visible type, unbreakable, wick-feed oiler made in three styles and in 1-, 2-, and 4-ounce capacities has just been placed on the market by the Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee, Wis. The oiler shown in the illustration is intended for economical use on machinery that operates intermittently. The lever at the top, when in a vertical position, starts the feed, and when turned to the side, shuts off the oil. There is no flooding and no waste of oil when the machine is idle. The amount of oil in the reservoir can always been seen at a glance.

When the oiler is filled above the point where the wick enters the center tube, the surplus oil drains into the bearing, flushing it thoroughly. When the oil recedes to the opening in the tube, the wick automatically feeds oil to the bearing by capillary action. Thus dirt and sediment cannot reach the bearing. All metal parts are bright cadmium-plated. 97

Wick-feed Oiler Made by the Trico Fuse Mfg. Co.

Gusher Coolant Pump for Small Machine Tools

The Ruthman Machinery Co., Cincinnati, Ohio, has recently added to its line of smaller pumps a Model P-3, which is made in various types and capacities especially for use on small lathes, grinders, honing and lapping machines, automatic lathes, and larger machines that require only a moderate volume of coolant.

Two Types of the New Model P-3 Ruthman Gusher Pumps

The new pump is of the same general design as the larger Gusher coolant pumps. The essential features include a built-in motor; rugged vertical shaft suspended on precision ball bearings; double-suction intake, which provides a balanced impeller; and special constructional details which provide for easy installation on both old and new machine tools.

These pumps have no packing nuts or foot or relief valves, and require no priming. Their patented double intake and balanced thrust impeller is built without metal-to-metal contact and is proof against injury by grit or small chips. They can be throttled down to provide a flow of coolant exactly suited to the work. The unique system of cooling the motor consists of drawing the

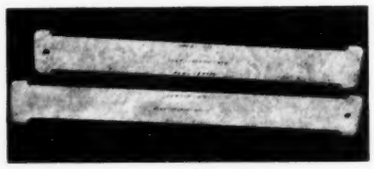
To obtain additional information on equipment described on this page, see lower part of page 148.

air downward through vents in the top of the motor. The vents are covered by a canopy which makes the motor practically an enclosed type.

The pumps are made in various capacities for handling soluble coolants and light, medium, and heavy oils. The capacities range from 2 to 10 gallons per minute. The driving motors are of 1/30 or 1/10 H.P., depending on the service required. These pumps are made with various types of mounting flanges and with different arrangements of inlet and exhaust ports. 98

"Go" and "No Go" Gages Tipped with Kennametal

The McKenna Metals Co., 147 Lloyd Ave., Latrobe, Pa., is placing on the market a line of "Go" and "No Go" gages tipped with Kennametal for use in the accurate gaging of cylinders, tubing, and other parts on which dimensions must be held to a close tolerance. The new "Go" and "No Go" gages consist of notched steel blanks with small pieces of Kennametal brazed to them at both ends, where the work is measured. The difference in width between the



Kennametal Tipped "Go" and "No Go" Gages

"Go" and the "No Go" ends on the two gages illustrated is 0.002 inch. However, gages can be made to measure any practical tolerance in almost any diameter.

Kennametal is also used to advantage on other types of gages and instruments, such as progressive plug gages, micrometers, etc. Another advantage of Kennametal when used on gages and micrometers, in addition to its wear-resisting qualities, is its non-rusting quality. This feature enables the gages to retain their accuracy for a long time. 99

Bethlehem Tool Steel

A special high-carbon, high-vanadium tool steel, suitable for a wide variety of uses ranging from heavy hogging cuts to fine finishing operations, has been developed by the Bethlehem Steel Co., Bethlehem, Pa. The new steel, known as "Red Tiger," represents a departure from standard practice in that the carbon content has been increased to give extra hardness, an average of 65C to 68C Rockwell hardness after heat-treatment being attained without excessive brittleness. The analysis of the new steel is approximately as follows: Tungsten, 18 per cent; chromium, 4 per cent; vanadium, 2.5 per cent; molybdenum, 0.60 to 0.80 per cent; and carbon, 1 per cent. Physical tests show impact properties approximately the same as standard carbon 18-4-1 high-speed steel. Shock-resisting properties make it possible to use this steel for intermittent cuts without danger of breakage.

The principal applications include both roughing and finishing cuts for all general purposes, such as machining heat-treated railroad car wheels and axles, cast iron, and heat-treated alloy steels. A cut 7/16 inch deep at a speed of 16 feet per minute has been used in machining heat-treated car wheels with a tool made from this steel. Car-wheel flange forming tools made from this steel have also given excellent service. 100

Where Does the Money Go To?

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has issued a financial report to its employes covering the company's 1939 business. This report sets forth, in simple fashion, how much the company received as income from all sources and how much was paid out for materials, wages, dividends, etc. Briefly, the company received a total of $176,653,428 from all sources in 1939. Of this amount, $80,916,341 was paid out in wages and salaries, and $68,928,688 was paid out for materials, supplies, fuel, transportation, and similar items.

The tax collector took $10,390,874 from the Westinghouse company in 1939. This was equivalent to a tax on the work of every employe of $238. The stockholders received less than the Government, or $9,349,421. In other words, the men who provided the money wherewith the machines and tools were bought that provided employment for the workers, and that erected the buildings in which the machines were housed and the work performed, received $3.50 for each share of stock, while the Government took $3.89 for each share.

What the Government gave in return for the more than $10,000,000 that it took from the Westinghouse company in 1939 is more difficult to itemize. Of course, the Government provides many services that have a direct money value; but how the bill of over $10,000,000 for services rendered would be itemized is somewhat difficult to comprehend. In other words, the Government took a great deal of this money without giving anything in return. Part of the tax was confiscation, possible because of the power of a Government, backed by the majority, to take anything it wants.

In addition to wages and salaries, the Westinghouse company set aside for employes $2,232,769 in the form of group insurance premiums and other benefits. After these disbursements were made, the company had a balance of $4,835,521 which was placed in reserve to take care of emergencies and expand the business, so that more jobs for workers could be created when the conditions warranted.

The average number of employes in 1939 was 43,732; their average age was 36 3/4 years; their average length of service, slightly over ten years. Of each 100 employes, 78 were men and 22 women.

* * *

Nautical Training Course for Young Men

The American Nautical Academy announces that boys and young men between the ages of eleven and twenty-one will be allowed to secure practical ship experience on board a training ship of the Academy within the period from July 1 to October 1, this year. The young men may remain on board ship for the entire period or for a shorter period, but not for less than one month. For further information, address Captain Oliver Bohld of the American Nautical Academy, National Training School for Merchant Marine Officers, Washington, D. C.

To obtain additional information on equipment described on this page, see lower part of page 148.

Production Contour Milling with Automatic Duplicator Control

Fig. 1. Reed-Prentice Vertical Miller Equipped with Automatic Duplicator Control Developed by Detroit Universal Duplicator Co.

CONTINUOUS milling of irregular contours such as found on articulated connecting-rods for aircraft engines is being performed as an entirely automatic operation through the use of a set-up employing a control unit developed by the Detroit Universal Duplicator Co., 227 St. Aubin St., Detroit, Mich.

This control unit is shown in Fig. 1 in operation on a Reed-Prentice vertical miller. In addition to the standard duplicator control unit and tracer head, a table-mounted plate, with guides adjustable for work of various sizes, is employed for milling the exterior of the drop-forged connecting-rod to within 0.0015 inch in about six minutes. The milling operation, following loading and starting of the machine, is entirely automatic, and enables a single operator to take care of a group of machines equipped for similar work.

To insure the accuracy required on work of this kind, the speed of both the table and the cross feeds are kept in proper relationship within close limits by means of a solenoid control clutch mechanism. This mechanism is connected to the table feed and is actuated by the superimposed impulse control of the tracer head. The changes in set-up required for handling work of a different size are accomplished by merely repositioning three escapements and relocating limit and reversing switches, all of which are easily adjusted.

The work is clamped on a plate, on which is also mounted an accurate templet such as shown at the left, Fig. 1, and at *A*, Fig. 2. The tracer head, mounted on the milling machine head, follows the templet, and through the duplicating control unit, which actuates the cross-feed of the table on which the plate is held, causes the work to move in a path corresponding to the exact outline or contour of the templet. The table is actuated by the regular power feed, if the machine has one, or by motor drive controlled by a solenoid clutch. Faster operation on various types of work is possible by employing a variable-speed drive.

To provide the change in feeding direction required to form-mill the connecting-rod, the equipment is provided with two escapement guides and a movable stop, mounted on the plate in proper relation to the templet, together with reversing switches located under the plate. When the machine is in operation, the initial motion, being back and to the right from the starting position, causes the tracing finger to encounter the first escapement, which guides it into contact with the templet. The finger follows the templet, as indicated by the diagram Fig. 2, until it reaches the extreme end of the work, at which point it passes between the second escapement guide and the templet.

Motion continues until the finger encounters a movable stop which sends the tracer to the right to clear the work. As the tracer passes the movable stop, a switch reverses the direction to a forward-left motion. The tracer finger returns to strike the second escapement, which guides it to the templet in the proper position for starting the second portion of the cut. The operation is completed when the tracer has passed between the first escapement and templet, at which point a limit switch automatically stops the machine.

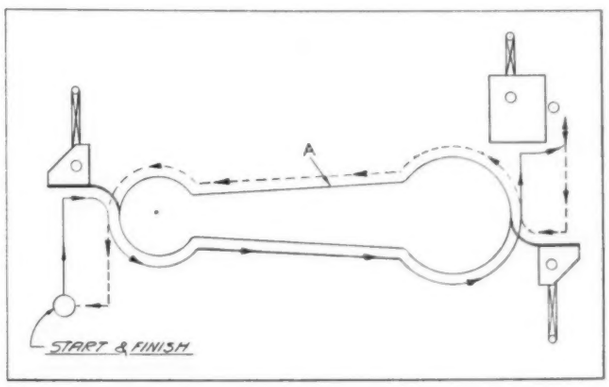


Fig. 2. Diagram Illustrating Use of Templet Employed with Equipment Shown in Fig. 1, for Contour-milling Articulating Connecting-rods

Long Experience Not Required in Making Reliable Welds

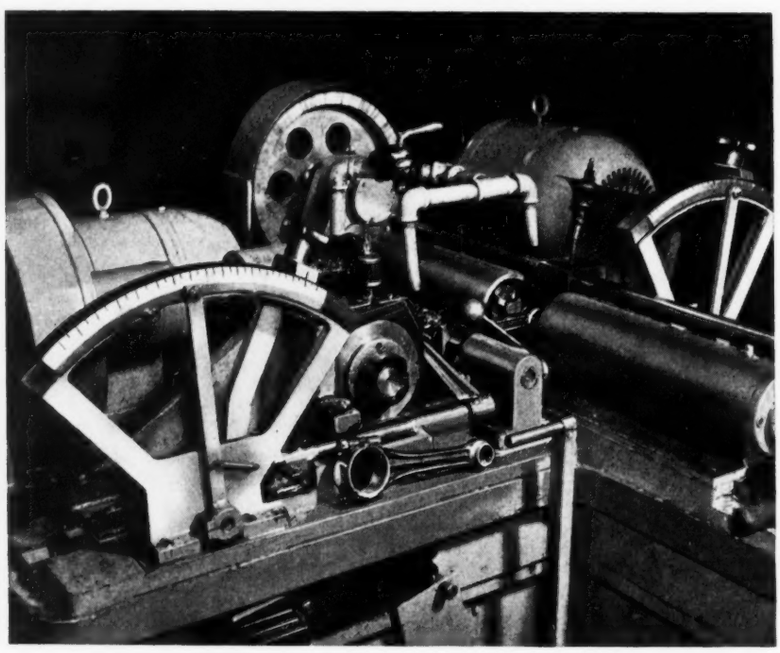
In order to demonstrate the safety and reliability of arc welding, tests were conducted of the first welds made by men who had never before held a welding arc. Five men among those attending a five-day welding course in Pittsburgh under the auspices of the Lincoln Electric Co., Cleveland, Ohio, were asked to each make three welds. When tested, the welds of the three men—the first they had ever made—varied from 46,000 to 55,000 pounds per square inch tensile strength. Of the five men, one was assistant manager of a fabricating plant; another, chief engineer of a construction company; the third, a designing engineer; and the fourth and fifth, a shop foreman and a plant superintendent.

The pieces welded were 1/4- by 1 1/2-inch mild steel bar stock. There was no scarfing or preparation of any kind. While the tensile strength of the welds made would obviously be less than that of welds produced by experienced welders using the same coated electrodes, the tests showed how readily safe welds can be produced. Experienced welders would have been able to produce welds with a tensile strength ranging from 65,000 to 75,000 pounds per square inch.

Correcting Automobile Connecting-Rods for Weight and Center of Gravity

Connecting-rods for the engines of automobiles built by the Pontiac Motor Division of the General Motors Corporation, Pontiac, Mich., must be of the specified weight within 1/16 ounce. They are inspected for weight and center of gravity on a double-end scale that weighs both ends of the rod at the same time. The necessary corrections are then made by the machine shown in the accompanying illustration, which is fitted with inserted-blade hollow-mills that take cuts around both ends of the wrist-pin boss and with straddle-mills that remove stock from the top of the cap.

Indicators on the quadrants seen at the front and back of the machine are set by the operator according to the weights obtained from the scale, and as the indicators are positioned, sliding wedges are automatically adjusted within the machine. When the machine is started up to make weight corrections on a connecting-rod, these wedges serve as stops for the hydraulically actuated tool-heads; thus the amount of stock removed by the cutters is automatically controlled. The connecting-rods are made heavy purposely, so that there will be no rejections for underweight.



Machine that Corrects Connecting-rods for Weight and Center of Gravity according to the Setting of Indicators along Two Graduated Quadrants

* * *

How to Lower the Standard of Living

When a foreign workman is not permitted to decorate a foreign building at a World's Fair without an American workman standing idle at his side, there are sure to be fewer foreign buildings and fewer World's Fairs than there might otherwise have been. When an industrial group maintains a monopoly price and a restricted output instead of taking a smaller unit profit on larger sales, the public has less to consume or to use than it might have had. When a government official arranges to have every third row of cotton ploughed under, he may be applying a palliative to some temporarily serious agricultural pain, but he is not permanently curing anything or raising the standard of living as a whole.—*Harvey N. Davis, President, Stevens Institute of Technology*

* * *

Awards for Long Service with Westinghouse

More than 21,000 employes of the Westinghouse Electric & Mfg. Co. have received service award emblems in recognition of ten or more years of service with the company. Of the 21,222 employes eligible to receive the award, 8 have been with the company for fifty years or more; 184 at least forty years; and 6062 over fifteen years. The service emblems are divided into nine classes, ranging from a solid gold emblem set with a full-cut diamond for those with fifty years service to a bronze emblem for ten years service.

* * *

A complete report of the aviation education survey recently made by the United States Office of Education, giving detailed information regarding types of training and the states that give such training, is available free from the U. S. Office of Education, Washington, D. C.

NEWS OF THE INDUSTRY

California

AXELSON MFG. CO., Los Angeles, Calif., has completed plans for plant expansion which, when carried out, will materially increase the plant capacity and facilitate deliveries of the heavy-duty lathes which the company builds in six sizes, from 14 to 30 inches. The company has entered into negotiations with representatives of the South American market, which has been greatly stimulated due to the cutting off of the supply of European machine tools by the war.

Illinois and Wisconsin

L. E. BLOCK has retired as chairman of the board of directors of the Inland Steel Co., 38 S. Dearborn St., Chicago, Ill., after twenty years' service in that capacity, and EDWARD L. RYERSON, JR., vice-chairman, has been elected his successor. Mr. Block will continue to serve the company as chairman of the executive committee. P. D. BLOCK, president, and all other officers were re-elected.

Edward L. Ryerson, Chairman of the Board of Directors of the Inland Steel Co.

J. ROY PORTER, president since 1928 of the Marshall & Huschart Machinery Co., Chicago, Ill., was named chairman of the board of directors last week at a banquet honoring his fifty years of service to the machine tool industry. Attending the dinner were more than sixty representatives of the industry, including the heads of the twenty-four machine tool companies represented by the Marshall & Huschart Machinery Co. Mr. Porter announced the election of GEORGE HABICHT, JR., as president and general manager. Mr. Habicht was formerly Mr. Porter's assistant. FRANK SEESE, formerly secretary and treasurer, relinquished his duties as secretary to his former assistant C. P. STOLLSTORFF, who becomes secretary of the company and remains assistant treasurer. GEORGE R. RAY continues as vice-president. All of the men affected by these changes have been with the company twenty-five years or more.

H. S. STROUSE, treasurer of the Harnischfeger Corporation, Milwaukee, Wis., was elected chairman of the Electric Hoist Manufacturers Association at the annual meeting held in Chicago, Ill., on May 10. F. F. SEAMAN, general manager, Robbins & Myers, Inc., Hoist and Crane Division, Springfield, Ohio, was elected vice-chairman.

TRICO FUSE MFG. CO., Milwaukee, Wis., has appointed the Huie-Simmer Co., 103 Thomas Bldg., Dallas, Tex., district sales representative in the state of Oklahoma. L. W. SLOANE, 408 Olive St., St. Louis, Mo., has been appointed district sales representative in St. Louis, Mo., and vicinity.

Indiana

GENERAL ELECTRIC CO., Decatur Works, Decatur, Ind., recently held an open house for the families, friends, and neighbors of the employes of the works, in commemoration of the twentieth anniversary of the starting of the plant. E. W. LANKENAU, superintendent of the works, and a group of thirty-three men and women who have been with the General Electric Co. since the Decatur Works was opened, were hosts for the occasion.

INDUSTRIAL EQUIPMENT DIVISION, CONTINENTAL ROLL & STEEL FOUNDRY CO., East Chicago, Ind., announces the establishment of a testing laboratory to make time and method studies on polishing and buffing operations. Manufacturers and platers are invited to make arrangements with the laboratory for sending sample parts for free tests.

J. A. ST. CLAIR has been made chief sales engineer of the Industrial Division of E. C. Atkins & Co., Indianapolis, Ind., manufacturer of Silver Steel saws. Mr. St. Clair has been associated with the company since 1901. For several years he has been connected with the engineering department in the capacity of engineer, and has also had charge of the service department.

G. E. HUNT has been placed in charge of the Indianapolis office, at 307 N. Pennsylvania Ave., of Cutler-Hammer, Inc., Milwaukee, Wis., manufacturers of electric motor control, safety switches, and allied electrical equipment.

Michigan

SHEET-WIRE CORPORATION has recently been organized at Detroit, Mich., to manufacture rods, bars, and wire by a new process. DEAN D. FRANCIS, formerly vice-president of the National Bronze and Aluminum Co., and president of the Wheeler-Schebler Carburetor Co., heads the new company as president and treasurer. F. E. BIRCH, previously chief engineer of the Buffalo Pressed Steel Co., and F. L. ARMSTRONG, formerly vice-president of the Thorne Motor Corporation and Gas-Electric Corporation, are vice-presidents; and ATHEL F. DENHAM, president of Denham & Co., is secretary and assistant treasurer.

VICKERS, INC., manufacturer of hydraulic pumps, valves, controls, and fluid motors, has let a contract for the construction of an addition to its plant at 1400 Oakman Blvd., Detroit, Mich., to the Austin Co. The new building will be a two-story structure and will contain 80,000 square feet. It will represent an investment of approximately $500,000.

O. L. BARD, for the last seventeen years secretary of the Michigan Tool Co., Detroit, Mich., and identified with the company almost since its inception, was elected president and treasurer at the annual meeting of the board of directors. MARVIN R. ANDERSON was elected vice-president, and ARVID LUNDELL was made secretary of the company.

LAWRENCE V. NAGLE was elected vice-president of the Udylite Corporation, Detroit, Mich., manufacturer of electroplating and polishing equipment and supplies, at a recent meeting of the board of directors. L. K. LINDAHL was re-elected president.

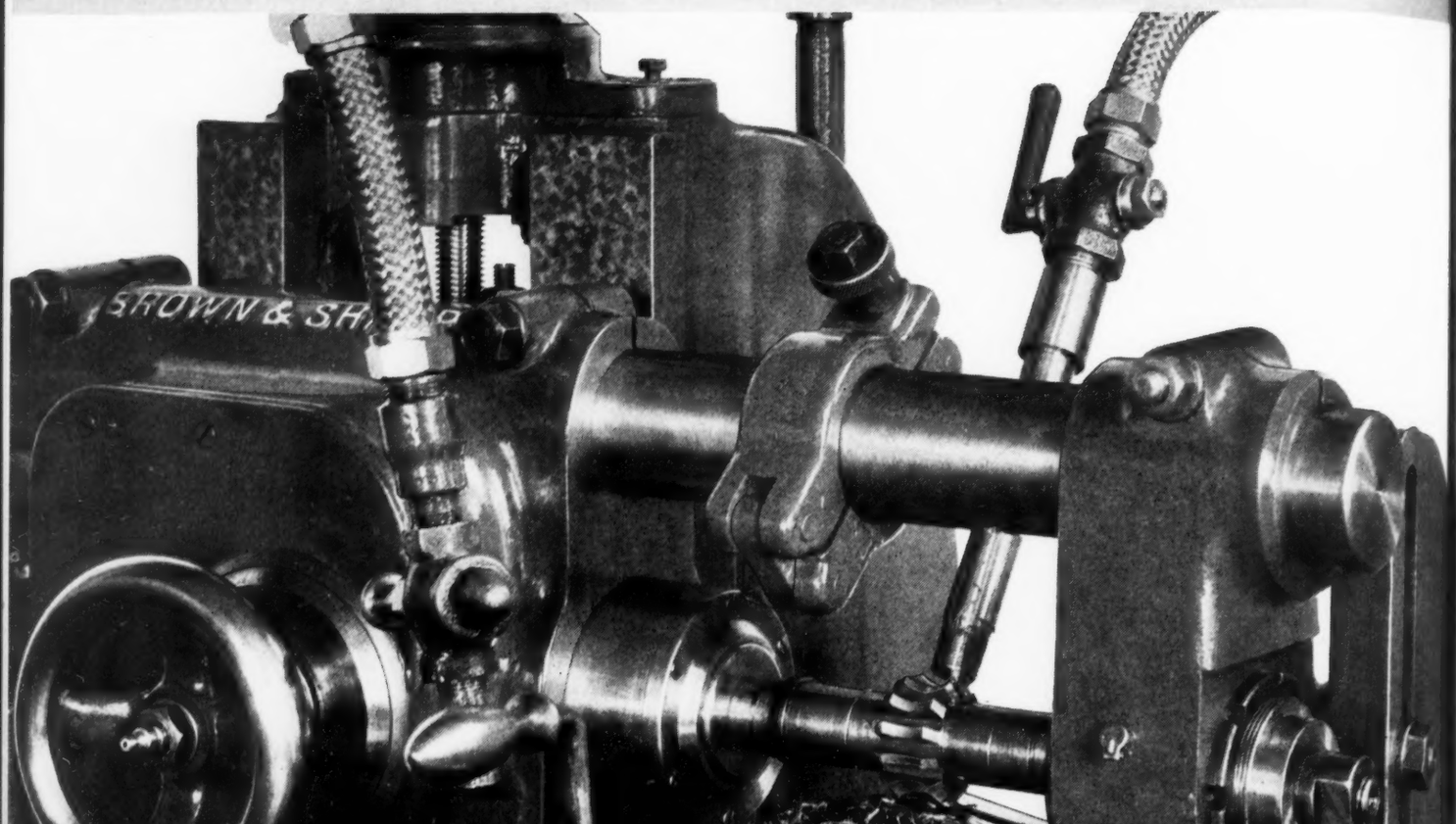
DENHAM & CO., Detroit, Mich., has been retained as public relations and publicity counsel by the American Society of Tool Engineers.

STURDY TOOL & ENGINEERING CO., manufacturer of broaching tools and fixtures, has moved into new quarters at 14520 Schaefer Highway, Detroit, Mich.

New England

EUGENE EDWARD WILSON was elected president of the United Aircraft Corporation, East Hartford, Conn., at a recent meeting of the board of directors, suc-

INVESTIGATE № 000



BROWN &

– for *LOWER* MILLING COSTS ON SMALL SECOND OPERATION WORK

• • • Metal-removing ability, combined with fast operation, gives the No. 000 a distinct advantage on second operation work in lowering costs.

- ***Automatic milling cycle*** minimizes operating time - - - operator has only to load work, press starting button, and unload work after cut.

- ***High rate of fast travel*** can be used throughout the entire table cycle, except for the cutting movement $\frac{1}{16}$″ longer than contact of work with cutter.

- ***Accurate reversal of table*** controls length of cut within close limits and is the equivalent of a positive stop.

- ***Single table dog*** provides quick set-up and permits those extremely short cuts heretofore profitably milled on Hand Machines only.

Rapidity of operation with precision of cut is well illustrated at the left, where the piece is milled to accurate form.

Ask for full information on the No. 000 Plain Milling Machine — a profitable producer that has established an enviable performance in the rapid production milling of small pieces. Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

B·S

SHARPE

ceeding the late Donald L. Brown. RAYCROFT WALSH, former general manager of Hamilton Standard Propellers Division, was elected vice-president, and will serve as executive assistant to Mr. Wilson. FREDERICK B. RENTSCHLER was re-elected chairman of the board.

GENERAL ELECTRIC CO., Schenectady, N. Y., is constructing a new $50,000 building for the Plastics Department of the company in Pittsfield, Mass., which is expected to be completed about the middle of June. The building will be of one-story construction, 165 feet long by 75 feet wide, and will be used for the development of new plastics on a small-scale production basis.

BRYANT CHUCKING GRINDER CO., Springfield, Vt., has recently let a contract to the Austin Co. for a 14,000 square-foot addition to its plant. This is the second such addition made in the last six months. The project will provide a new machine shop with three 30-foot bays, and will represent an investment of more than $40,000.

New York and New Jersey

GEORGE C. MILLER has been appointed sales manager of the Plastics Division of the Carbide and Carbon Chemicals Corporation, Unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York City. Mr. Miller has been associated with the Plastics Division since the development of Vinylite resins.

PAUL N. ROBINS has been elected vice-president and treasurer of Greene, Tweed & Co., 101 Park Ave., New York City, manufacturer of metal packings and mill supply specialties. Mr. Robins was associated for thirteen years with the Manufacturer's Trust Co. as assistant vice-president, specializing in the industrial field. Prior to that time he was engaged in advertising and marketing.

STOW MFG. CO., INC., Binghamton, N. Y., manufacturer of flexible-shaft machines, has recently added the following firms to its distributor organization: RUNDLE-SPENCE MFG. CO., Milwaukee, Wis.; R. W. HUDGINS CO., 1 Commerce St., Norfolk, Va.; STACY SUPPLY CO., Springfield, Mass.; DIXIE MILL SUPPLY CO., 901 Tchoupitoulas St., New Orleans, La.; R. C. NEAL CO., 76 Pearl St., Buffalo, N. Y.; CHASE PARKER CO., 288 Congress St., Boston, Mass.; HAWAIIAN SALES FACTORS LTD., 1074 Ala Loana Blvd., Honolulu, Hawaii; DEHLER BROS. CO., 116 Market St., Louisville, Ky.; J. H. RYDER MACHINERY CO., 55 York St., Toronto 2, Ont., Canada; CHAS. A. STRELINGER CO., 149 E. Larned St., Detroit, Mich.; MANNING, MAXWELL & MOORE, 446 Communipaw Ave., Jersey City, N. J.; and CASANAVE SUPPLY CO., 2028 Sansom St., Philadelphia, Pa.

RAWLPLUG CO., INC., 98 Lafayette St., New York City, manufacturer of anchoring devices, has appointed ALEXANDER MITCHELL manager of the Rawlplug Albany Co., 434 Clinton Ave., Albany, N. Y. W. F. O'KEEFE will cover the Syracuse territory, under the direction of the Albany office.

UDYLITE CORPORATION, Detroit, Mich., manufacturer of electroplating and polishing equipment and supplies, has removed its eastern district office from 30 E. 42nd St. to 60 E. 42nd St., New York City. A. B. HOEFER is eastern district manager.

F. L. ROBERTSON, 56-58 Rano St., Buffalo, N. Y., has recently taken over the manufacture and distribution of the single-pull countershafts and belt-shifters formerly made by the Builders Iron Foundry, Providence, R. I.

VASCOLOY-RAMET CORPORATION, North Chicago, Ill., has appointed H. BOKER & CO., INC., 101 Duane St., New York City, selling agents for Vascoloy-Ramet tantalum-carbide cutting tools and blanks.

HENRY NELKIN, INC., 128 Mott St., New York City, electroplaters and polishers, have added another floor to their plant and installed two new departments for baking and enameling, and tumbling.

ACHESON COLLOIDS CORPORATION, Port Huron, Mich., announces that RAYMOND SZYMANOWITZ, technical director, and his staff, are now located at 1019 Broad St., Newark, N. J., in the company's new research laboratories.

Ohio

CHARLES J. MARTIN has been appointed chief engineer of the Federal Machine & Welder Co., Warren, Ohio. Mr. Martin has had a wide experience in the designing and building of high-production precision machine tools, special machines, and equipment. He was assistant chief engineer of the Ford Motor Co. from 1923 to 1934, in charge of the designing of all production equipment. From 1934 to 1940, he was affiliated with the Ex-Cell-O Corporation, of Detroit, in the capacity of machinery salesman and sales engineer. FRANK J. SCHUMAN has been appointed works manager of the company. Mr. Schuman is a graduate of Lehigh University in mechanical engineering. He was previously associated with the Standard Tube Co., of Detroit, as works manager, and

©Underwood & Underwood

Paul N. Robins, Newly Elected Vice-president and Treasurer of Greene, Tweed & Co.

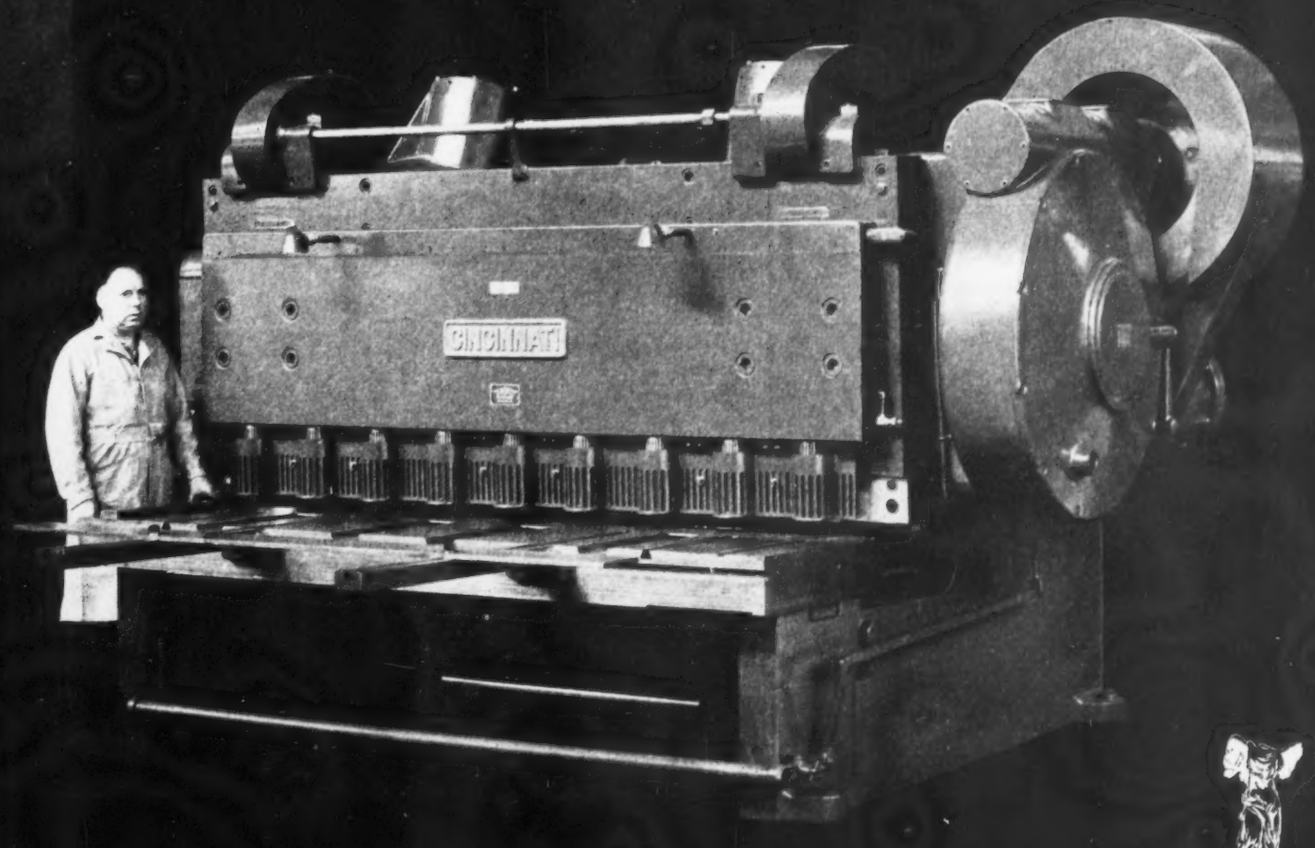
Charles J. Martin, New Chief Engineer of the Federal Machine & Welder Co.

Frank J. Schuman, Works Manager of the Federal Machine & Welder Co.

SHEARING 1" PLATE to a SQUARE EDGE

. . . exclusive features of the Cincinnati All-Steel Shear give accurate, square cuts. 46 standard sizes . . . capacities from 10 gauge to 1¼".

Write for recommendations on your job.



THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

SHAPERS • SHEARS • BRAKES

with the S. R. Dresser Mfg. Co., of Bradford, Pa., in the capacity of plant superintendent.

GAMES SLAYTER, Newark, Ohio, the inventor of Fiberglas, which is constantly finding more and more important applications in industry, was awarded the Edward Longstreth Medal on May 15 by the Franklin Institute, Philadelphia, Pa. The medal is given in recognition of meritorious work in science and the industrial arts. Mr. Slayter is vice-president of the Owens-Corning Fiberglas Corporation, Toledo, Ohio, and is in charge of research and development. At least eight of the principal United States patents in the Fiberglas field have been issued to him.

MONARCH MACHINE TOOL CO., Sidney, Ohio, has started work on a 20,000-square foot addition to its plant which will add approximately 15 per cent to the present capacity. The building extension has become necessary to house approximately $200,000 worth of new production equipment ordered since the first of the year.

NORMAN L. DEUBLE is now associated with the Copperweld Steel Co. at Warren, Ohio, as assistant to vice-president. Mr. Deuble is a graduate of the Case School of Applied Science with the degrees of B.S. and Metallurgical Engineer. He was previously with the Republic Steel Corporation.

WILLIAM TAGGART has been appointed manager of tube sales for the Timken Roller Bearing Co., Canton, Ohio. Mr. Taggart has been associated with the company since 1928, and prior to that was employed by the Republic Steel Corporation.

CARPENTER STEEL CO., Reading, Pa., announces that a complete line of Carpenter tool steels is now stocked in Dayton, Ohio, by the INDUSTRIAL FABRICATED STEEL CO., 1300 E. Monument Ave., Dayton, Ohio.

Pennsylvania and Maryland

E. F. HOUGHTON & CO., Third, American, and Somerset Sts., Philadelphia, Pa., producers of cutting and quenching oils, and leather and metal products, recently presented their old employes with gold service emblems in honor of the seventy-fifth anniversary of the company. Of the 324 men and 77 women who received these emblems, 110 men and 39 women have been employed by the concern for from ten to twenty years; 30 men and 15 women from twenty to thirty years; and several for more than thirty years.

JAMES C. MORGAN has been promoted from the post of general sales manager of the Philadelphia Division of the Yale & Towne Mfg. Co. to the position of general manager of the entire Philadelphia plant. Mr. Morgan has been associated with the company for twenty years. S. W. GIBB, assistant general sales manager for the last nine years, will succeed Mr. Morgan as general sales manager. Mr. Gibb has also been connected with the company for twenty years.

S. F. NEWMAN has been elected president of the Landis Tool Co., Waynesboro, Pa., manufacturer of precision grinding machines. M. A. HOLLENGREEN has been advanced from the office of assistant general manager to that of vice-president. Mr. Newman has been actively associated with the machine tool industry for many years. He was connected originally with the Landis Tool Co. from 1899 to 1908. Then he went with the Landis Machine Co. of Waynesboro, which he served in an executive capacity for a number of years, having been vice-president prior to accepting his present appointment. Mr. Newman is at present on the board of directors of the National Machine Tool Builders Association. Mr. Hollengreen was associated with the Landis Machine Co. as assistant chief engineer from 1926 to 1936. In the latter year, he joined the Landis Tool Co. as assistant general manager.

C. B. BOYNE has been appointed manager of stainless-steel sales for the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Mr. Boyne was previously manager of stainless bar and wire sales, and has been connected with the company since 1913. J. R. KUMER, JR., will succeed Mr. Boyne as manager of stainless bar and wire sales. He was formerly assistant to Mr. Boyne, and has been with the company since 1926.

ROLLER-SMITH CO., 1766 W. Market St., Bethlehem, Pa., has moved the switchboard division of the company to a recently acquired plant in Allentown, Pa. The air and oil circuit-breaker and instrument divisions will remain in Bethlehem. J. E. BEVAN will be the manager of the Allentown plant.

WILFRED A. CLABAULT has been appointed advertising manager of the Roller-Smith Co., 1766 W. Market St., Bethlehem, Pa., manufacturer of electrical measuring and protective devices.

WARD LEONARD ELECTRIC CO., Mount Vernon, N. Y., has opened a branch office in the Hearst Tower Building, Baltimore, Md. WILSON K. WINBIGLER is in charge of the new office.

Oklahoma, Texas, and Louisiana

O. G. HOUSER, 310 Thompson Bldg., Tulsa, Okla., has been appointed sales representative in the states of Arkansas, Kansas, and Oklahoma, and parts of Texas and Missouri, for Logansport Machine, Inc., Logansport, Ind., manufacturer of air and hydraulically operated chucks, cylinders, valves, presses, and accessories.

MORSE CHAIN CO., Ithaca, N. Y., has opened a new branch office at 1418 Polk

S. F. Newman, Newly Elected President of the Landis Tool Company

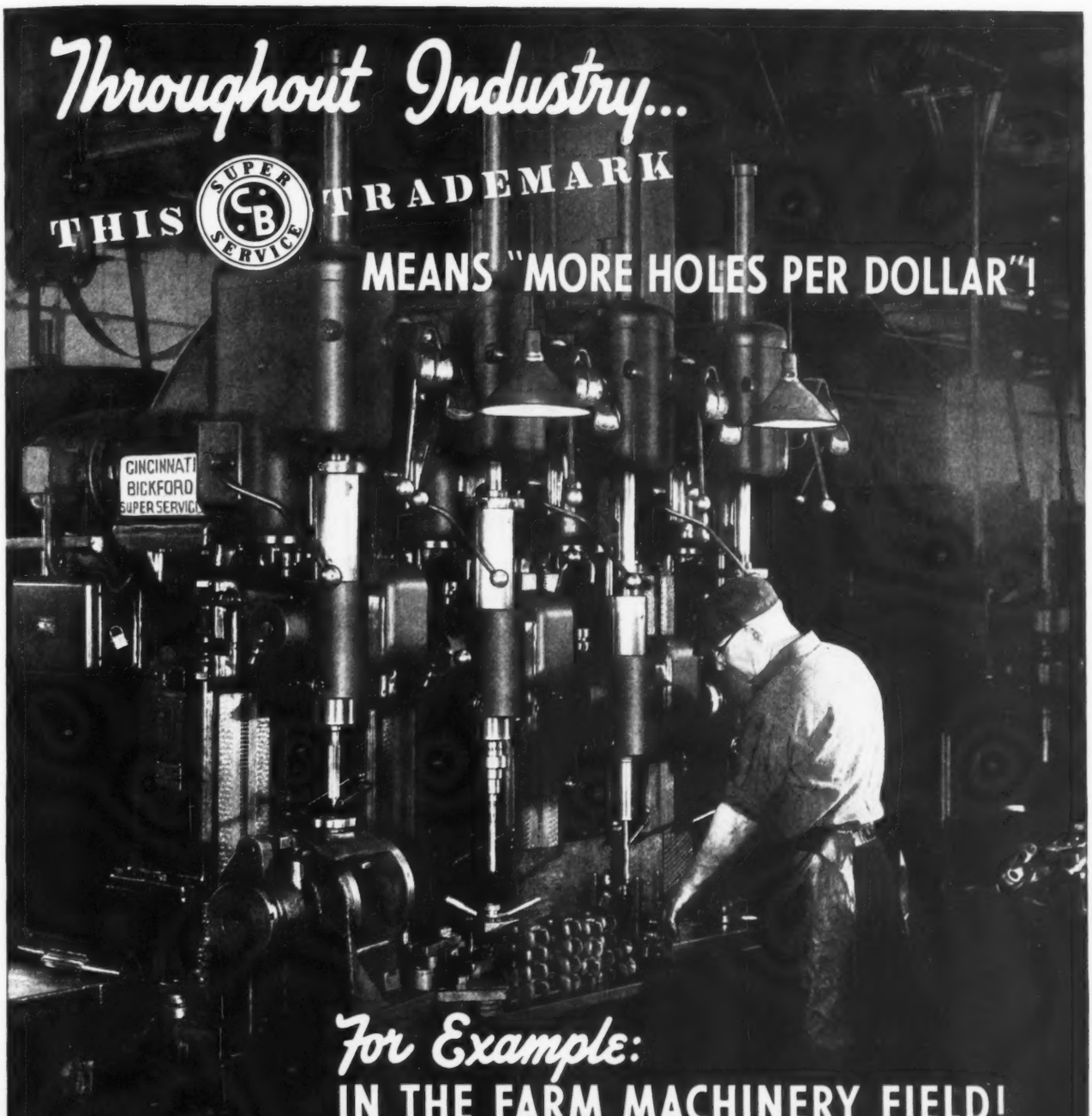
M. A. Hollengreen, New Vice-president of the Landis Tool Company

Bob Koch, Manager of the Houston, Tex., Branch of the Morse Chain Co.

Throughout Industry...

THIS SUPER C.B SERVICE TRADEMARK

MEANS "MORE HOLES PER DOLLAR"!



For Example:

IN THE FARM MACHINERY FIELD!

● One of the world's largest manufacturers of heavy agricultural equipment was recently faced with the problem of stepping up parts drilling production. The new machines would have to be placed in groups to conserve manpower. They would have to be versatile enough to adapt themselves easily and quickly to a great variety of work — reaming, spot facing and tapping, as well as drilling — yet maintain high precision.

The logical solution: Two Cincinnati Bickford 4 spindle gang drills of the all-geared, Super Service type. Since this installation, various operators have been using these drills three shifts daily on many types of parts. They and company officials were more than pleased with the way their needs were filled! Write today for a free copy of Bulletin 4-25, and study the possibilities with Super Service upright drills in your plant.

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

St., Houston, Tex. BOB KOCH, assistant sales manager for the last five years, has been made manager of the new branch. Complete stocks of the Morse line of power transmission products will be carried at the Houston branch.

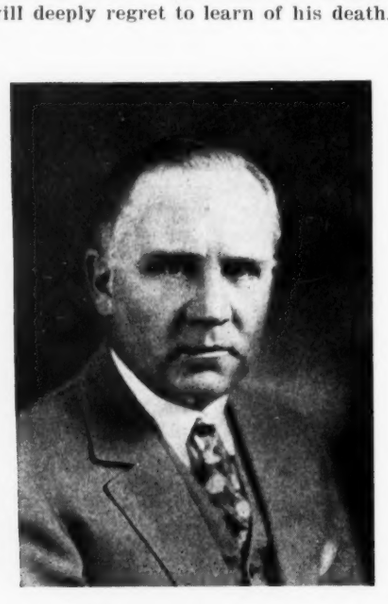
R. F. HEATH has been transferred from the Houston, Tex., territory of Manning, Maxwell & Moore, Inc., Bridgeport, Conn., to the New Orleans district, formerly covered by JACK SCHUYLER.

OBITUARIES

Charles H. Johnson

Charles H. Johnson, executive vice-president and director of the Gisholt Machine Co., Madison, Wis., died on April 23 at the age of fifty-eight years. Mr. Johnson had spent his entire life in the machine tool industry, having started to work for the Gisholt Machine Co., as a machinist in 1897, while he was still in his teens. Later he went to Europe as a demonstrator and assistant in sales. His selling ability soon became recognized, with the result that he was promoted to the position of European manager, with headquarters at Cologne, Germany. On his return to Madison in 1918, he was promoted to a vice-presidency in the company. In 1932, he became executive vice-president.

Mr. Johnson was well known both here and abroad as one of the outstanding men in the machine tool industry. He had an unusually friendly personality, and was loved by all with whom he came in contact. His countless friends will deeply regret to learn of his death.



Charles H. Johnson

William R. Mitchell

William R. Mitchell, executive vice-president of the National Acme Co., Cleveland, Ohio, died at his home in Cleveland Heights on May 8, following an illness of four months. Mr. Mitchell was born in Syracuse, N. Y., on December 23, 1878. His parents moved to Cleveland while he was still a boy. After attending the Fairmount School, he became associated with the National Acme Co. in 1902, when a nucleus of the present organization moved from Hartford to Cleveland to engage first in the screw product business which later expanded to include machinery, tools, and allied products.

At the time of his death Mr. Mitchell had served the company continuously for thirty-eight years, and was the oldest employe in length of service. In 1912, he was made superintendent of the Product Division, and during the first World War when the plant was devoted to government needs, he organized the company's production activities as general superintendent. During the 1920's, he was for three years manager of the Detroit Sales Division, after which he returned to Cleveland as a vice-president. In 1933, he was made executive vice-president.

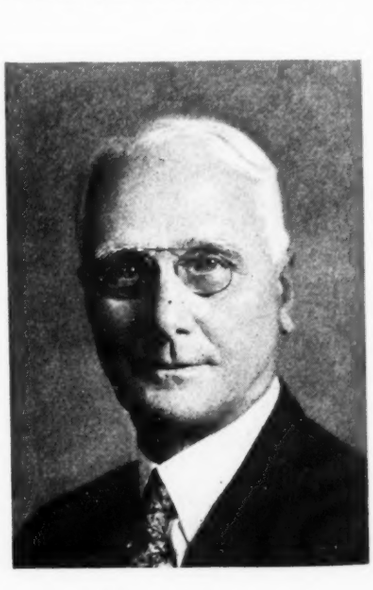
Capable and friendly, Mr. Mitchell was far more than a business associate. He earned the respect and loyalty of a wide circle of acquaintances and the esteem and affection of many friends throughout the industry he served. He is survived by his wife and two daughters.

Edwin F. Northrup

Dr. Edwin Fitch Northrup, vice-president and technical adviser of the Ajax Electrothermic Corporation, Trenton, N. J., died at his home in Princeton, N. J., on April 29, at the age of seventy-four. Dr. Northrup was born in Syracuse, N. Y., in 1866. He graduated from Amherst College in 1891, attended Cornell University the latter half of the same year, and obtained his doctorate at Johns Hopkins University in 1895. Dr. Northrup was professor of physics for a short time at the University of Texas. Later he worked with Professor H. A. Rowland of Johns Hopkins University in the development of the multiplex printing telegraph system, and became chief engineer of the Rowland Printing Telegraph Co. In 1903, Dr. Northrup and Maurice E. Leeds formed the Leeds & Northrup Co. Dr. Northrup was associated with this firm until 1910, during which period he invented the movement that made possible the automatic recording instrument as it is known today.

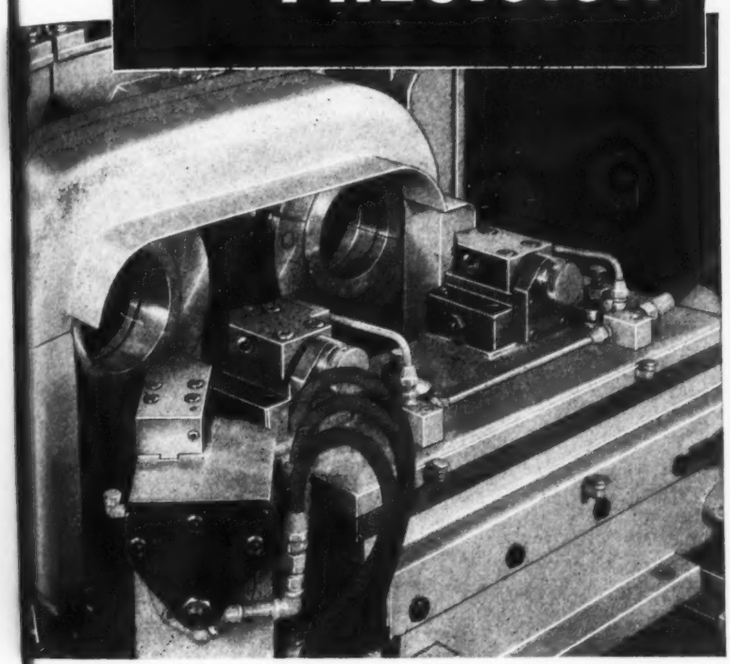
From 1910 to 1916, Dr. Northrup did research work and taught physics and electrical engineering at Princeton University. It was during that period that he started the development of the high-frequency or coreless induction furnace, and from 1916 until his death he was actively engaged in the development and application of that product. He invented means for concentrating energy to an unprecedented degree, whereby differential surface heating for surface hardening might be effected. For his scientific achievements and furnace development, honors were showered upon him from every corner of the globe. He was awarded the Medaille de Bronze at the Paris Exposition in 1900; the Edward Longstreth Medal in 1912; the Elliott Cresson Medal in 1916 and the Edward Goodrich Acheson Gold Medal and $1000 in 1931. Two months before his death he was cited as a "Modern Pioneer" in a national survey honoring those who have done most to advance industry in the American way.

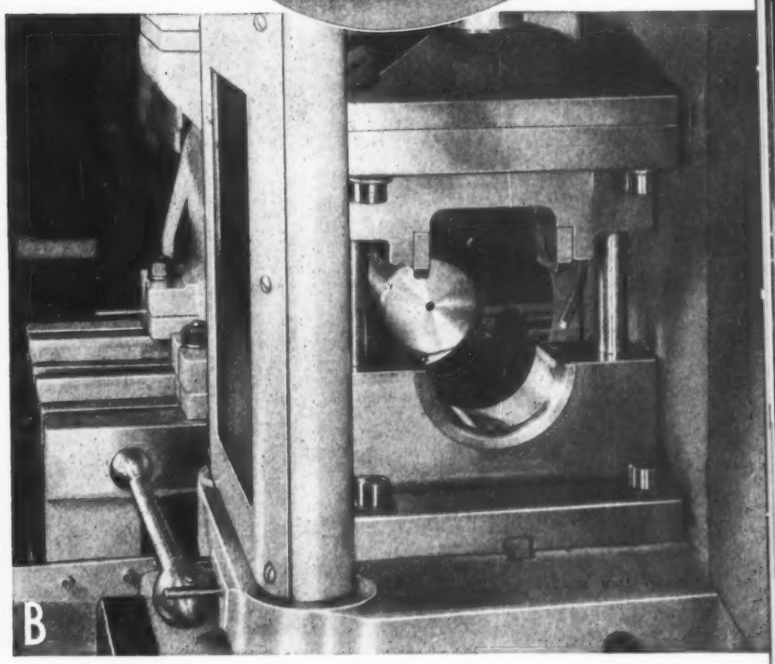
During his life Dr. Northrup published many papers and books. He was awarded over one hundred United States patents on his inventions, and in 1932, at the dedication of the new United States Patent Office in Washington, D. C., he was honored as one of the



Edwin F. Northrup

• WHEN BORING *demands* EXTREME PRECISION





. . . EX-CELL-O MACHINES ARE THE LOGICAL ANSWER!

To the supreme standard of accuracy that automobile and aircraft engine manufacturers have brought so effectively to modern industry, Ex-Cell-O Precision Boring Machines have contributed in a practical and outstanding way.

Illustrated here is one of many applications. Indispensable requirements of micro-inch finish are easily and surely met in the machining of half and full bearings for the master connecting rod of a nationally known airplane motor.

Illustration A shows an Ex-Cell-O Precision Boring Machine (Style No. 112C) used for turning the radius and chamfering ends of bearing. In illustration B is shown the same style machine used for the finish boring operation (either half or full bearing). The Ex-Cell-O fixture illustrated is adjustable in clamping pressure necessary to produce the desired result in finishing bearings of this type—pressure anywhere up to 6000 lbs. is available.

These applications are typical of many others that are being successfully made. Numerous modifications are possible.

Wherever precision is a requirement, along with production and economy, Ex-Cell-O Precision Boring Machines enter definitely into the picture. Send details of your boring, turning or facing problem to Ex-Cell-O *today*.

EX-CELL-O CORPORATION • 1212 OAKMAN BLVD. • DETROIT, MICH.

• Ex-Cell-O Style No. 112-C Senior Single-End Precision Boring Machine provides an efficient and economical method for handling many types of applications. Use the coupon for information on this and other styles of Ex-Cell-O Precision Boring Machines.

EX-CELL-O CORPORATION,
1212 Oakman Blvd., Detroit, Mich.

Please send me literature on Ex-Cello-O Precision Boring Machines.

Name _____

Firm _____

Address _____

EX-CELL-O Precision MACHINES AND TOOLS

twelve leading American inventors of the day. He was a life member of the American Institute of Electrical Engineers and a Fellow of the American Association for the Advancement of Science. He was also a member of the American Electrochemical Society and the Franklin Institute.

WALTER S. RUGG, retired vice-president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and widely known throughout the electrical industry as an engineering and sales executive, died on April 25 in New York after a heart attack, at the age of seventy-four. He began his electrical career as a student engineer in the Westinghouse organization in 1892. Three years later he went to the Chicago office as district engineer, afterward being transferred to the sales force. After serving as manager of the Railway Department and of the Marine Department, he became general sales manager of the company, and in 1925 was elected vice-president. In that office he was in charge of both engineering and sales activities of the company.

PERCY H. KNIGHT, a retired employe of the Westinghouse Electric & Mfg. Co., died at his home in Costa Mesa, Calif., on May 4. He was seventy-two years old and had been with the company for forty years.

* * *

Ryerson Holds Open House at the Chicago Plant

Joseph T. Ryerson & Son, Inc., held open house at the Chicago plant May 11, on which occasion the company was host to more than 3000 visitors. The event marked the opening of a large additional building, in which the guests were served a buffet luncheon. The guests were also taken on specially conducted tours through the entire plant, where the many services and products of the company were on display. One hundred and fifty guides stationed throughout the warehouses and offices explained the many technical exhibits and processes.

Special demonstrations were conducted in the Ryerson laboratory, including the making of tensile, hardness, and bending tests. A feature of the tour was a visual explanation of the Ryerson Certified Steel Plan. Visitors were asked to select heat symbols from the large stocks available, after which the corresponding heat-treatment charts showing the exact chemical composition and physical properties of the steel were pulled from the files and placed in their hands. The system used for filling all orders with great dispatch—more than 95 per cent of all orders are shipped the same day that they are received—was also explained, and the warehouse activities of interest to the more technically inclined guests were thoroughly demonstrated.

NEW BOOKS AND PUBLICATIONS

INDUSTRIAL DESIGN. By Harold Van Doren. 388 pages, 6 by 9 inches, in addition to a supplement of 32 pages showing halftones of industrial designs; 189 line illustrations. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $4.50.

Industrial design, as the term is used in this book, has been recognized as a specialized pursuit for a little more than a decade. The need for a book on the subject is apparent. With interest in industrial design rising rapidly, there is still no literature for the beginner. The job of an industrial designer is to interpret the function of useful things in terms that appeal to the eye; to endow them with the beauty of form and color; and above all, to create customer approval and buying appeal.

To accomplish these things, the designer needs not only talent, but technique. No book can create talent, but it can supply background for technique. This book has been prepared for the purpose of helping designers to circumvent some of the avoidable errors that have been made in the past for lack of just such a guide as this. For the last ten years the author has practiced this new profession with no thought other than to create merchandise that the public would buy. He has now temporarily undertaken the role of teacher with the view of speeding the day when the importance of design will be given its place in the industrial world in the same manner as engineering, advertising, or management itself.

PLASTICS IN ENGINEERING. By J. Delmonte. 465 pages, 6 by 9 1/4 inches. Published by the Penton Publishing Co., Cleveland, Ohio. Price, $7.50, postpaid.

This book discusses the progress and extent of applications of plastics to design problems. It is believed to be the first work prepared directly for the designer on the subject of plastics. The author is a recognized authority on the subject, who has gained much of his knowledge through first-hand experimental work and actual application. At present he is assistant to the chief engineer of the Chicago Flexible Shaft Co., and also conducts a course on plastics at Armour University Graduate School in Chicago.

In order to give a complete understanding of the potentialities of plastic materials, both the advantages and the disadvantages are discussed in terms of various engineering problems. Several chapters have been devoted to the chemistry of plastics and to the art of molding them. The laminating, casting, and extruding of organic plastics also receive attention. In view of the close relationship that surface coatings and synthetic rubbers bear to plastic materials, a chapter is devoted to each of the two former subjects.

MACHINE DESIGN DRAWING-ROOM PROBLEMS. By C. D. Albert. 441 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $3.50.

This is the third edition of a book, the purpose of which is to offer complete material for a drawing-room course in general machine design. In the present revision, eight new problems have been added, as well as four new chapters, and much of the material has been revised. Following an introductory chapter there are thirteen chapters, each of which is devoted to a distinct design problem. The next eight chapters of the book discuss engineering materials; allowable stresses; straight and helical spur gears; wormgearing; graphics; tolerances and allowances for metal fits; bearings; and screw threads and screw fastenings. A final chapter contains miscellaneous information in tabular form.

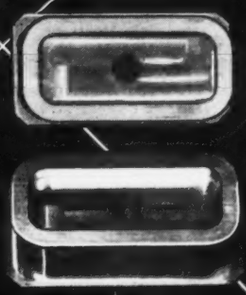
DICTIONARY OF METALS AND THEIR ALLOYS. Edited by F. J. Camm. 245 pages, 5 1/2 by 8 1/2 inches. Published by the Chemical Publishing Co., Inc., 148 Lafayette St., New York City. Price, $3.

This is a book containing a comprehensive list of metals, together with a description of their composition and characteristics. As far as is known, this is the first alphabetically arranged dictionary of metals and their alloys yet published. The aim has been to give information on every known metal and almost every type of commercial metallic alloy. Special sections have been included on hardening, casehardening and tempering, electroplating, polishing, chemical coloring, metal-spraying, and rustproofing.

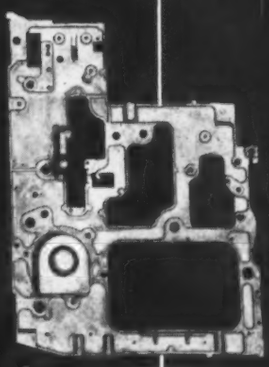
ARTIFICIAL LIGHT AND ITS APPLICATION. 296 pages; over 400 illustrations. Distributed by the Westinghouse Electric & Mfg. Co., Lamp Division, 150 Broadway, New York City. Price, $1.25, postpaid.

This is a new edition of a comprehensive work on lighting, which has been brought up to date to include the latest practice. The information should be of value to lighting engineers, as well as to students and laymen. The material covers lighting in every field,

FROM *Blue-Print* INTO *Steel* IN A SINGLE SET-UP



FORMING DIE
Milled from solid to tolerances of .0005 in 4¼ hours. Can be group milled in lots of 6 at the rate of 2½ hours per piece.



DIE CAST TIME CLOCK FRAME
Note numerous radii and great amount of detail work —produced with speed and accuracy on the Model D.

DISTRIBUTOR COUNTER WEIGHT
All four cavities completed in a total time of 72 hours — previous time, ordinary equipment, 156 hours.

EXAMPLES OF ROTARY HEAD TOOL AND DIE MILLING MACHINE PERFORMANCE . . .

HERE are a few of hundreds of examples of the Rotary Head Method of tool and die making with a Milwaukee Model D — the machine that transmits blueprint into steel in a single set-up — layout, milling, drilling, precision boring and slotting operations!

Investigate this machine and the new technique it offers for the production of dies and tools—in far less time, with positive accuracy, and at costs much lower than ever thought possible.

K&T

Milwaukee
MODEL D-ROTARY HEAD TOOL AND DIE MILLING MACHINE

EARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN, U.S.A.

including schools, industrial plants, commercial buildings, homes and farms, streets and highways, flood lighting, electrical advertising, etc. Chapters are also included on germicidal radiations, and photographic lamps and their applications.

THE HARDENABILITY OF CARBURIZING STEELS. By Walter H. Bruckner. 64 pages, 6 by 9 inches. Published by the Engineering Experiment Station of the University of Illinois, Urbana, Ill., as Bulletin No. 320. Price, 75 cents.

INDEX TO A.S.T.M. STANDARDS. 152 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Copies are available to those interested without charge.

* * *

Gisholt Makes First Fifty-Year Service Awards

Fifty years ago this spring, two young men started to work for the Gisholt Machine Co., Madison, Wis. These men —A. C. Anderson and A. G. Hansen— still in the company's employ, have just been honored as the first recipients of the Gisholt Diamond Service Pin, denoting a half-century of active service. Mr. Anderson is today general foreman in charge of assembly and testing of machines. He has supervised the building of many thousands of turret lathes. Mr. Hansen is connected with the engineering department as tool estimator, a position that he has held since 1913. These men each have a son also connected with the Gisholt company, John Anderson as field service demonstrator, and C. E. Hansen as a member of the engineering department.

COMING EVENTS

JUNE 5-7 — Conference of scientists, engineers, and research leaders in industry on the subject of FRICTION AND SURFACE FINISH, to be held at the Massachusetts Institute of Technology. For further information, address John J. Rowlands, Massachusetts Institute of Technology, Cambridge, Mass.

JUNE 9-14 — Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Greenbrier Hotel, White Sulphur Springs, W. Va. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

JUNE 17-20 — Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Pfister, Milwaukee, Wis. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

JUNE 22-30—MANAGEMENT CONFERENCE, under the auspices of Stevens Institute of Technology, at Johnsonburg, N. J. For further information, address Arthur E. Blirer, assistant to the president, Stevens Institute of Technology, Hoboken, N. J.

JUNE 24-28 — Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Atlantic City, N. J. C. L. Warwick, secretary-treasurer, 260 S. Broad St., Philadelphia, Pa.

JUNE 25-29—PRODUCTION AND MACHINE TOOL SHOW—an independent exhibition —to be held in the Cleveland Public Auditorium, Cleveland, Ohio. Richard C. Bonner, manager, Grafton, Wis.

SEPTEMBER 3-6 — Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Spokane, Wash. Further information may be obtained by addressing C. E. Davies, secretary, 29 W. 39th St., New York City.

SEPTEMBER 18-20 — Eighteenth annual conference of the NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION to be held at the Hotel Statler, Detroit, Mich. For further information, address National Industrial Advertisers Association, Inc., 100 E. Ohio St., Chicago, Ill.

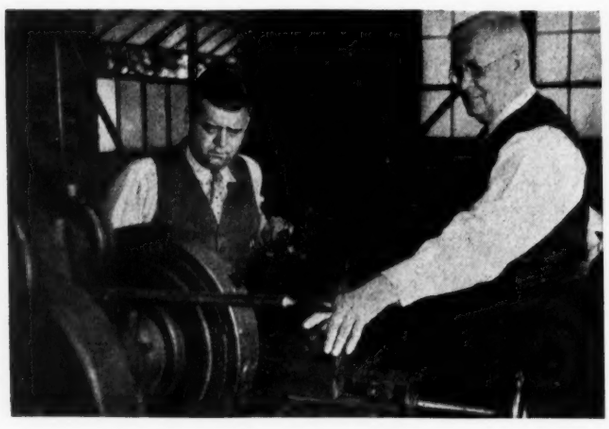
OCTOBER 7-11—NATIONAL SAFETY CONGRESS AND EXPOSITION to be held at the Stevens Hotel, Chicago, Ill., under the auspices of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 8-12 — SOUTHERN POWER AND ENGINEERING SHOW in the Armory Auditorium, Charlotte, N. C. For further information, address Junius M. Smith, vice-president, Southern Power and Engineering Show, Inc., P. O. Box 1225, Charlotte, N. C.

OCTOBER 21-25 — NATIONAL METAL EXPOSITION, to be held at Cleveland, Ohio, under the auspices of the American Society for Metals. W. H. Eisenman, secretary, 7301 Euclid Ave., Cleveland, Ohio.

DECEMBER 2-5—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in New York City. For further information, address C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 2-7 — Fourteenth NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING to be held at the Grand Central Palace, New York City. For further information, address International Exposition Co., Grand Central Palace, New York City.



A. C. Anderson, the First Employe of the Gisholt Machine Co. to Complete Fifty Years of Service with the Company, Explaining to his Son John, a Gisholt Field Service Demonstrator, the Features of an 1890 Model Gisholt Turret Lathe which Mr. Anderson Helped to Build

A. G. Hansen, Who has Completed Fifty Years with the Gisholt Machine Co., Discusses Turret Lathe Tooling with his Son, C. E. Hansen, Who has been with the Gisholt Company for Twenty-one Years, and Who is Now a Member of the Engineering Department